Relio R9 ARM9 RISC Embedded Computer

USER MANUAL

ITEM# RELIO R91001

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ESD Warnings

ELECTROSTATIC DISCHARGES (ESD)

A sudden electrostatic discharge can destroy sensitive components. Proper packaging and earthing rules must therefore be observed. Always take the following precautions.

- Transport boards and cards in electrostatically secure containers or bags.
- Keep electrostatically sensitive components in their containers, until they arrive at an electrostatically protected workplace.
- Only touch electrostatically sensitive components when you are properly earthed.
- Store electrostatically sensitive components in protective packaging or on anti-static mats.

GROUNDING METHODS

The following measures help to avoid electrostatic damages to the device:

- Cover workstations with approved antistatic material. Always wear a wrist strap connected to workplace as well as properly grounded tools and equipment.
- Use antistatic mats, heel straps, or air ionizers for more protection.
- Always handle electrostatically sensitive components by their edge or by their casing.
- Avoid contact with pins, leads, or circuitry.
- Turn off power and input signals before inserting and removing connectors or connecting test equipment.
- Keep work area free of non-conductive materials such as ordinary plastic assembly aids and Styrofoam.
- Use field service tools such as cutters, screwdrivers, and vacuum cleaners which are conductive.
- Always place drives and boards PCB-assembly-side down on the foam.

Introduction

The Relio R9 is an application-ready platform for your next product design. The system is based on the 200MHz Atmel AT91SAM9263 microcontroller boasting a 32-bit ARM® instruction set for maximum performance. With up to 256MB RAM and 256MB NAND Flash memory, the unmatched I/O features of the Relio R9 extend the possible uses beyond traditional ARM applications.

To provide the fastest time to market, the Windows CE 6.0 BSP binary and low-level drivers for system I/O are included. Additionally, the Relio R9 software package is equipped with the Sealevel Talos I/O Framework, which offers a high-level object-oriented .NET Compact Framework (CF) device interface. This interface provides an I/O point abstraction layer with built-in support for the specific needs of analog and digital I/O such as gain control and debouncing.

The Relio R9 is housed in a rugged, small enclosure suitable for mounting almost anywhere and is rated for a full -40˚ – +85˚C operating temperature range. The Relio R9 is powered from your 7-30VDC source, or select from a variety of Sealevel power supply options.

FEATURES

- Atmel AT91SAM9263 ARM® Processor
- Up to 256MB SDRAM and 256MB NAND Flash Memory
- Dual SD/MMC Expansion Card Slots
- LCD and Backlight Controller
- Resistive Touchscreen Controller
- 10/100 BaseT Ethernet
- Two USB 2.0 Ports; USB Device Port
- CAN Bus Interface
- On-board Serial, Digital, and Analog I/O
- Compatible with Windows Embedded CE 6.0 and Linux
- Low Power Requirements
- Power and Status LED Indicators

Before You Get Started

WHAT'S INCLUDED

The Relio R9 is shipped with the following items. If any of these items are missing or damaged, please contact Sealevel for replacement.

- Relio R9 ARM9 Embedded RISC Single Board Computer
- SD Card with CE runtime image, Talos .NET Framework, application samples, and documentation
- CD with Setup files and documentation
- Microsoft® Windows® CE 6.0 Core license

ADVISORY CONVENTIONS

Warning - The highest level of importance used to stress a condition where damage could result to the product or the user could suffer serious injury.

Important – The middle level of importance used to highlight information that might not seem obvious or a situation that could cause the product to fail.

Note – The lowest level of importance used to provide background information, additional tips, or other non-critical facts that will not affect the use of the product.

QUICKSTART KIT

The Relio R9-KT QuickStart kit is available, which includes the most common accessories. For applications with specialized hardware requirements, developers can use the Relio R9 as a platform for application development while Sealevel designs a customized target system specific to the user's application requirements.

The Relio R9-KT includes the following items:

- Relio R9 - ARM9 Embedded RISC Computer
- SD Card with CE runtime image, Talos .NET Framework, application samples, and documentation
- CD with Setup files and documentation
- Microsoft Windows CE 6.0 Core License
- TR123 – 100-240VAC to 12VDC @ 2.5A, wall mount power supply
- CA356 - USB Type A to SeaLATCH USB Type B, Device Cable
- CA429 - R9 serial debug cable
- CA246 - CAT5 patch cable, 6' length

OPTIONAL ITEMS

Depending upon your application, you are likely to find one or more of the following items useful with the Relio R9. All items can be purchased from our website (www.sealevel.com) by calling our sales team at (864) 843-4343.

CABLES

USB Type A to USB Type B, 72" in Length - Device Cable (Item# CA179)	
The CA179 is a 72" standard USB device cable that connects USB peripherals with a Type B connector to the Type A connector on a host computer. The CA179 is USB 2.0 compliant and is compatible with USB 1.1 and 1.0 devices.	
CAT5 Patch Cable, 7' in Length – Blue (Item# CA246)	
Standard 7' CAT5 UTP Patch Cable (RJ45).	
R9 Serial Debug Cable, 72" in Length (Item# CA429)	
The CA429 is a 72" serial debug cable with a 1x4 connector on one end and a standard DB9F connector on the other end. The DB9F connector is compatible with any standard RS-232 DB9M serial port.	

POWER SUPPLY

100-240VAC to 12VDC @ 2.5A, Wall Mount Power Supply (Item# TR123)	
The TR123 is a wall mount (wall wart style) power supply rated for 100-240VAC input and 12VDC output at 2.5 amps. The 72" cable has tinned leads for use with products that have screw terminals for input power. The white line or printing on the insulation indicates positive polarity.	

Product Overview

SPECIFICATIONS

PROCESSOR

Atmel (AT91SAM9263) — 200MIPS RISC Processor
16KB Data Cache, 16KB Instruction Cache, Write Buffer
Integrated Memory Management Unit (MMU)

MEMORY

Up to 256MB SDRAM (64MB Standard)
256MB NAND Flash
Two SD Memory Card Sockets

LCD CONTROLLER

Supports Passive or Active Displays
16-bit Color in TFT/STN Modes
Resolution Up to 2048 x 2048

TOUCHSCREEN CONTROLLER

Supports 5-wire Resistive Touchscreens

BUS INTERFACES

10/100 BaseT Ethernet
USB Device Port
Two USB 2.0 Ports
CAN Bus
Dedicated RS-485 Expansion

INDUSTRIAL I/O

Four Software Configurable RS-232/422/485 Ports
Eight Optically Isolated Inputs (5 – 24V)
Eight Open-Collector Outputs (5 – 30V; 3 with PWM)
Eight Analog Inputs (12-bit or 16-bit)
Two 32-bit Quadrature Counters

INDICATORS

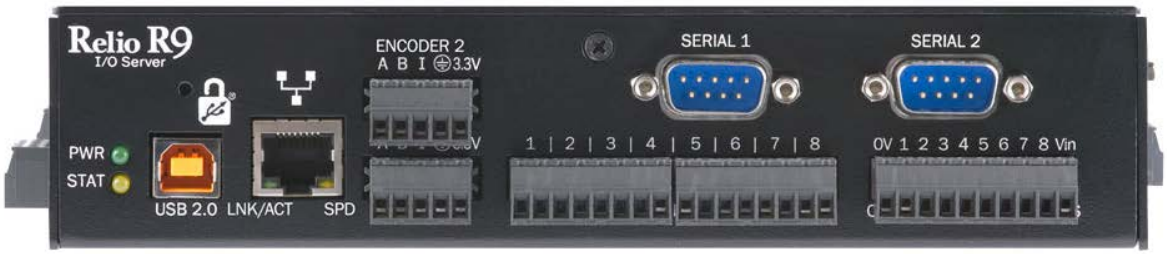
Dual LED Indicators for Power and Status

PRODUCT VIEWS

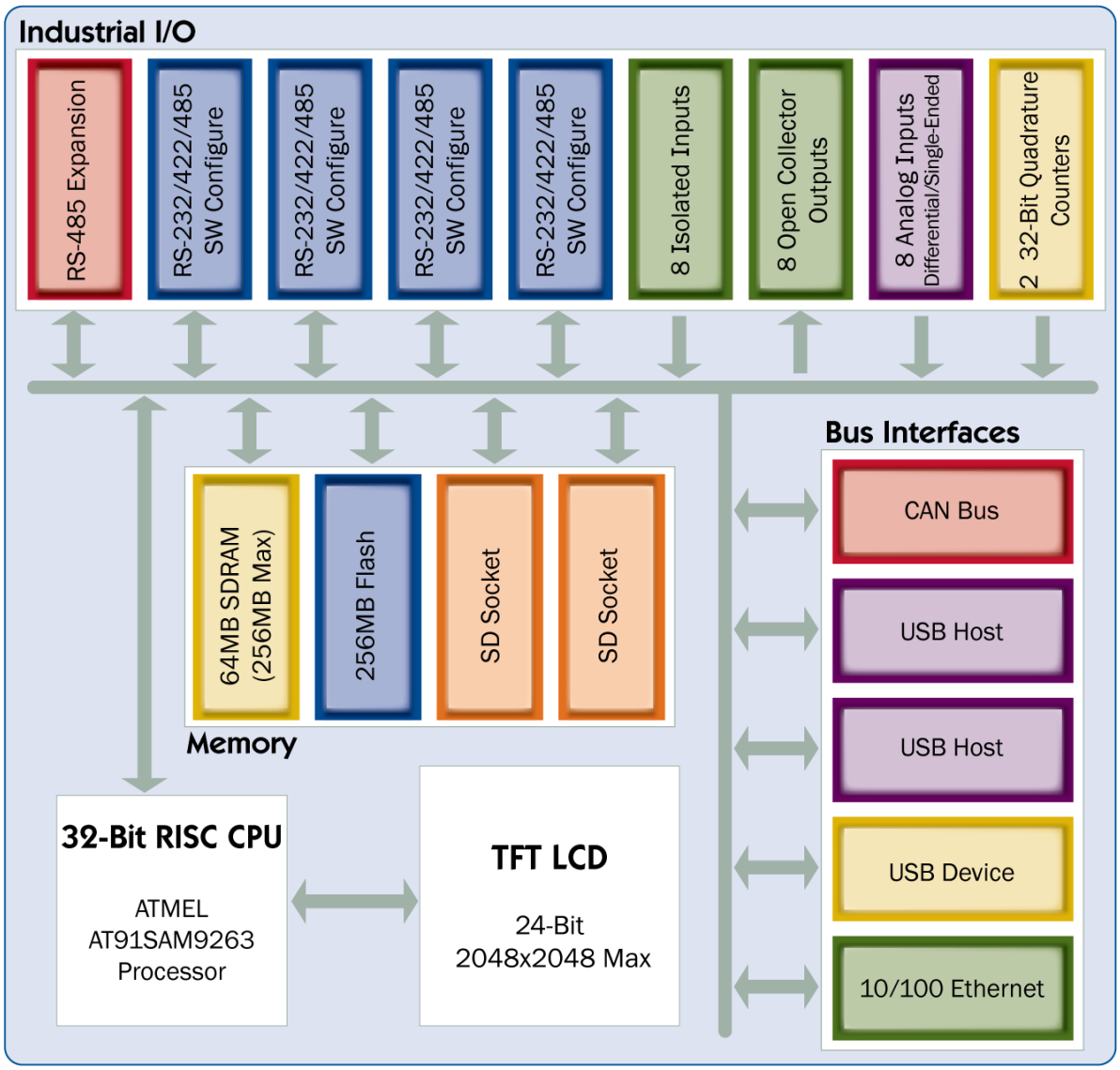
RELIO R9 LEFT

RELIO R9 RIGHT

RELIO R9 FRONT



BLOCK DIAGRAM



See Appendix B for the Connector Reference Table, which details the connectors, jumpers, and test points located on the Relio R9.

Technical Description

MEMORY

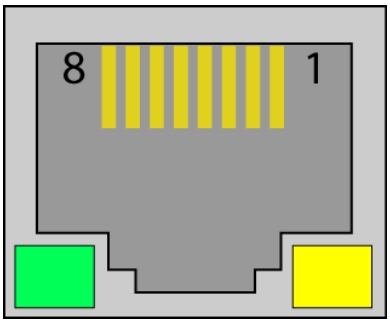
The Relio R9 base configuration includes 64MB SDRAM and 256MB NAND Flash. For memory intensive applications, the board can be ordered preconfigured with up to 256MB SDRAM.

ETHERNET

The Relio R9 includes a 10/100 BaseT Ethernet interface accessed via the RJ45 connector located on the front of the enclosure.

The RJ45 port on the left side of the Relio R9 is a RS-485 Expansion Port (labeled "RS-485 OUT") and is NOT an Ethernet port. Damage to Ethernet networking equipment can result if connected to the RS-485 RJ45 connector.

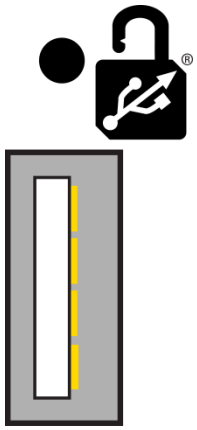
Pin	Signal
1	TX+
2	TX-
3	RX+
4	NC
5	NC
6	RX-
7	NC
8	NC



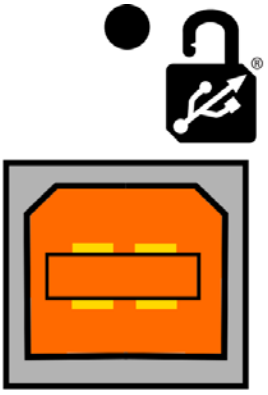
USB

The Relio R9 provides two SeaLATCH USB 2.0 host ports, and one SeaLATCH USB device port. The USB host ports are located on the left side of the enclosure. The USB device port is located on the front of the enclosure.

Connector: SeaLATCH USB 2.0 Host Port
Manufacturer: Samtec
Description: Standard USB Type A
Mates with: SeaLATCH USB Type A, or Standard USB Type A



Connector: SeaLATCH USB 2.0 Device Port
Manufacturer: Samtec
Description: Standard USB Type B
Mates with: SeaLATCH USB Type B, or Standard USB Type B



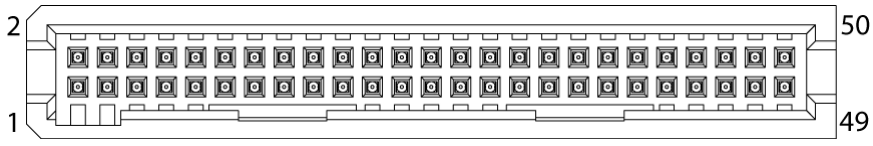
LCD AND TOUCHSCREEN CONTROLLERS

A variety of LCDs can be directly controlled by the Relio R9's on-board LCD controller. All LCD power and control signals are available on header connector P2. To access you will need to remove the cover of the Relio R9.

Connector:	P2
Manufacturer:	Samtec
Part Number:	TFML-125-02-S-D
Description:	Locking terminal strip, 50 pos, 0.050" pitch
Mates with:	Samtec SFML-125-T2-S-D or Samtec TFMDL-25-T-03.00

Position	Signal
1	GND
2	DCLK
3	HSYNC
4	VSYNC
5	GND
6	R0
7	R1
8	R2
9	R3
10	R4
11	R5
12	GND
13	G0
14	G1
15	G2
16	G3
17	G4
18	G5
19	GND
20	B0
21	B1
22	B2
23	B3
24	B4
25	B5

Position	Signal
26	GND
27	LCDEN
28	3.3V
29	3.3V
30	HDMODE
31	VDMODE
32	NC
33	NC
34	NC
35	NC
36	Touch UL
37	Touch LL
38	Touch UR
39	Touch LR
40	Touch Wiper
41	NC
42	NC
43	NC
44	NC
45	LCDLED3
46	GND
47	LCDLED2
48	GND
49	LCDLED1
50	GND

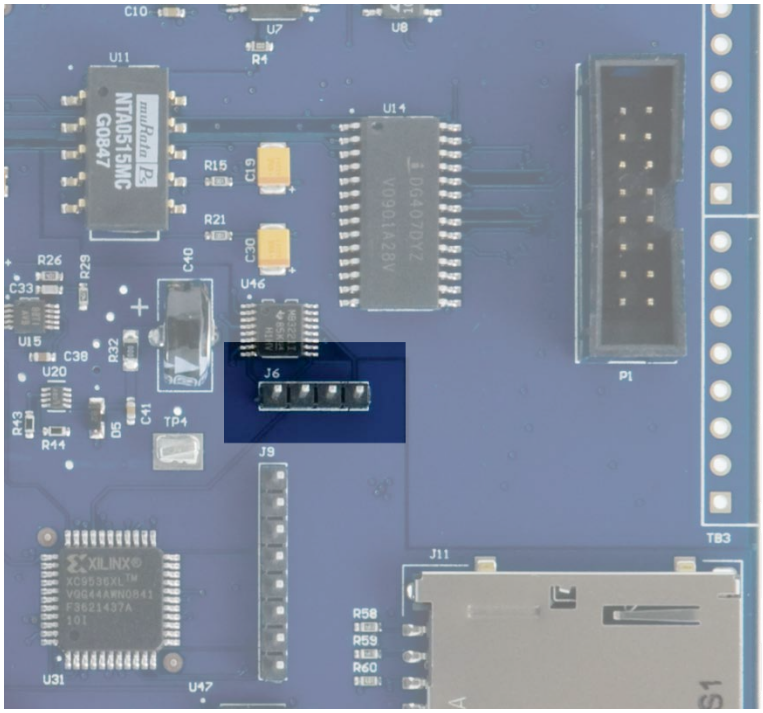


SERIAL DEBUGGING

Debug the R9 through the RS-232 debug port. To access you will need to remove the cover of the Relio R9.

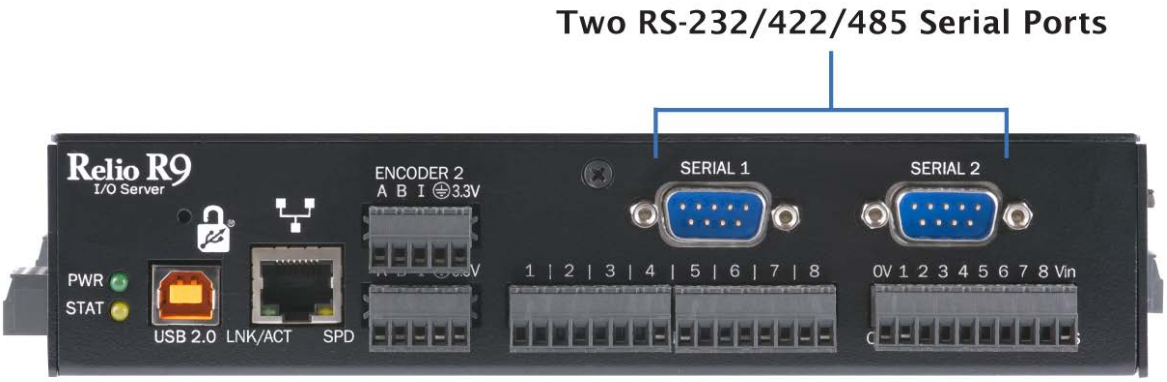
Connector: J6
Manufacturer: Amp/Tyco
Part Number: 9-146278-0-04
Description: Header, 0.100” Polarized 4 pos, pin 3 Removed

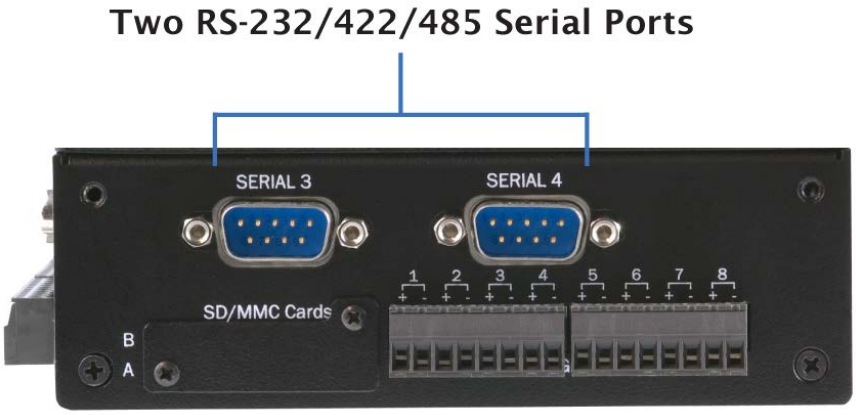
Pin	RS-232
1	RX
2	GND
3	Key
4	TX



SERIAL COMMUNICATIONS

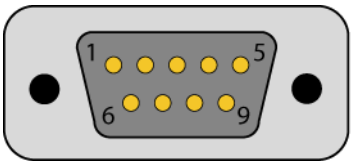
Connect to a variety of serial peripherals via the Relio R9's software configurable RS-232/422/485 ports. The serial port interfaces are available on DB-9 male connectors. Serial 1 and Serial 2 ports are located on the front of the enclosure, and Serial 3 and Serial 4 ports are located on the right side of the enclosure.





Connectors: Serial 1 – Serial 4
Description: DB-9 Male

PIN	RS-232	RS-422/485
1	DCD	RX+
6	DSR	NC
2	RX	RX-
7	RTS	NC
3	TX	TX-
8	CTS	NC
4	DTR	TX+
9	RI	NC
5	GND	GND



COM Port Assignments

Serial Port	Assignment
RS485 Expansion Port	COM1
SERIAL1	COM2
SERIAL2	COM3
SERIAL3	COM4
SERIAL4	COM5

CAN BUS

Connect directly to a Control Area Network (CAN) bus via the CAN connector on the left side of the enclosure.

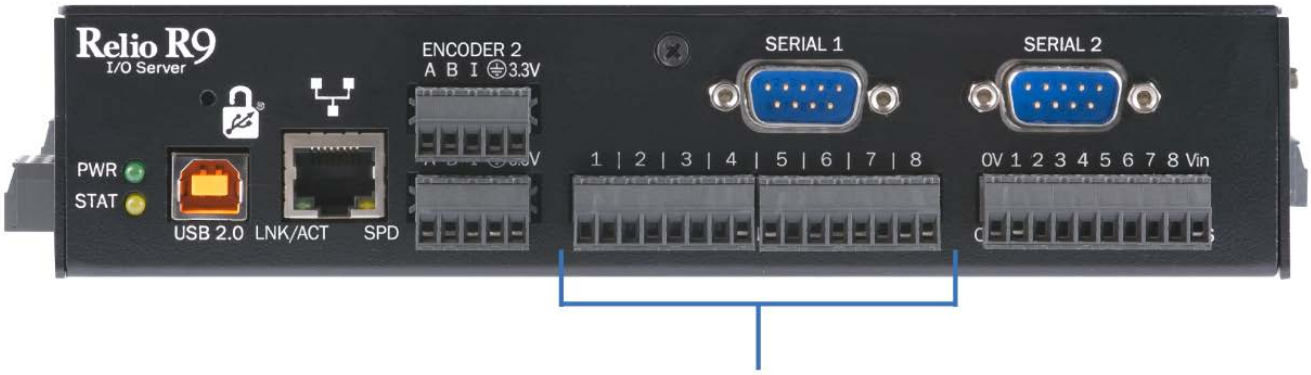
CAN Bus Port

Connector: CAN
Manufacturer: Weco
Part Number: 110-M-111/04
Description: Terminal Block 4 position 3.5mm spacing
Mates with: Weco 110-A-111/04 4 position screw-terminal plug (provided)

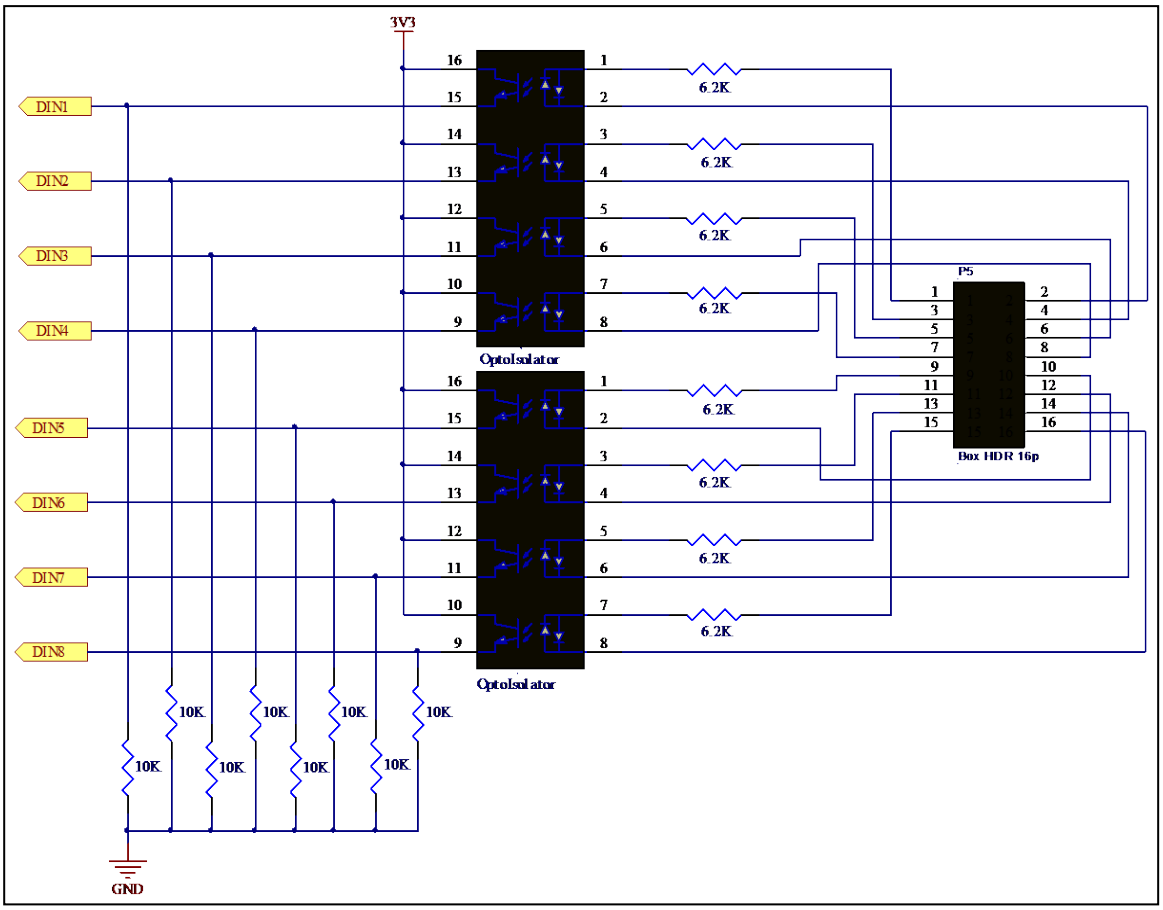
Pin	Signal
H	CAN High
⏚	GND
L	CAN Low
S	Shield

OPTICALLY ISOLATED INPUTS

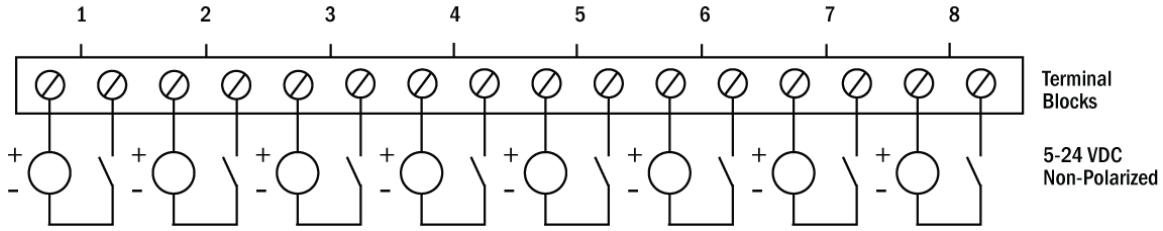
Interface 8 optically isolated inputs. The non-polarized inputs can range from 5-24VDC and provide 300V external isolation. Connection is made at on the front of the enclosure.



Eight Optically Isolated Inputs



8 Optically Isolated Inputs

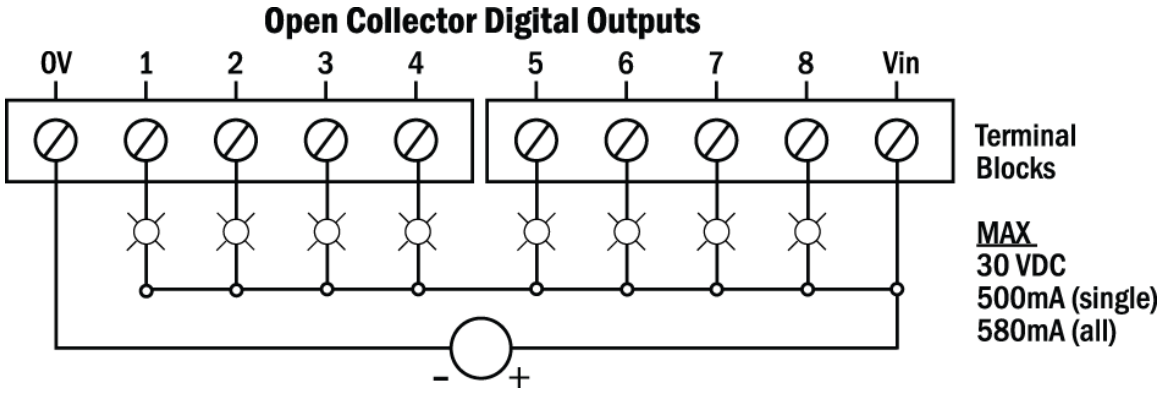


Connector: OPTO INPUTS
Manufacturer: Weco
Part Number: (2) 110-M-111/08
Description: (2) Terminal Block 8 position 3.5mm spacing
Mates with: (2) Weco 110-A-111/08 8 position screw-terminal plugs (provided)

Pin	Signal
1	Input 1A
	Input 1B
2	Input 2A
	Input 2B
3	Input 3A
	Input 3B
4	Input 4A
	Input 4B
5	Input 5A
	Input 5B
6	Input 6A
	Input 6B
7	Input 7A
	Input 7B
8	Input 8A
	Input 8B

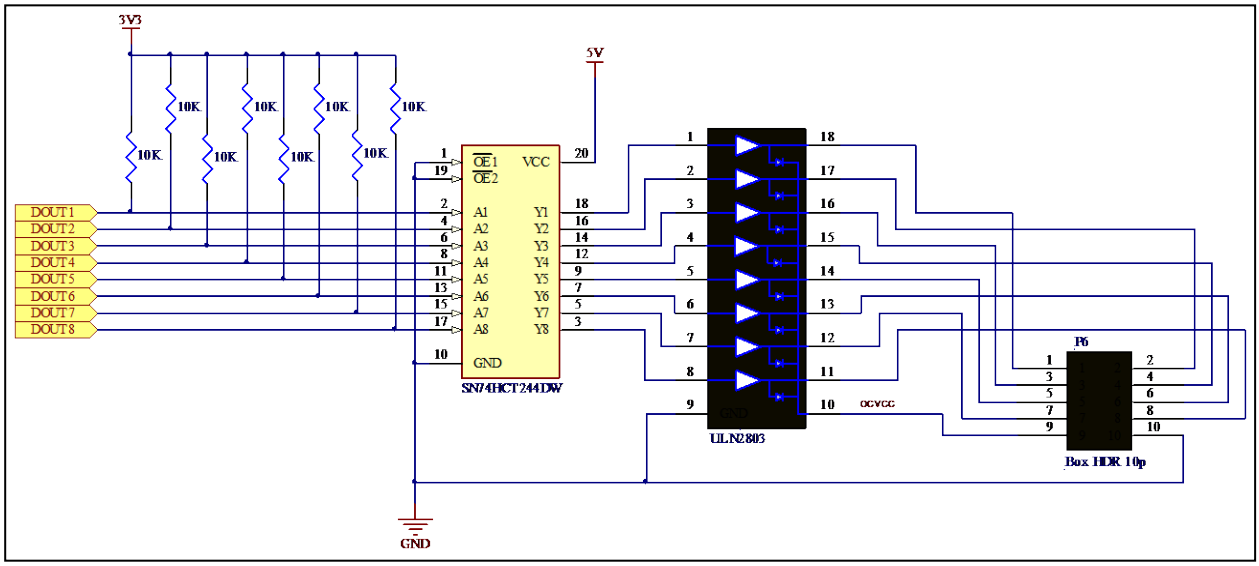
OPEN COLLECTOR OUTPUTS

Directly control eight outputs via the Relio R9's open-collector outputs found on the front of the enclosure. The open collector outputs have a range of 5 – 30V with a maximum sink current of 500mA on a single output with a combined maximum sink current of 580mA on all outputs.



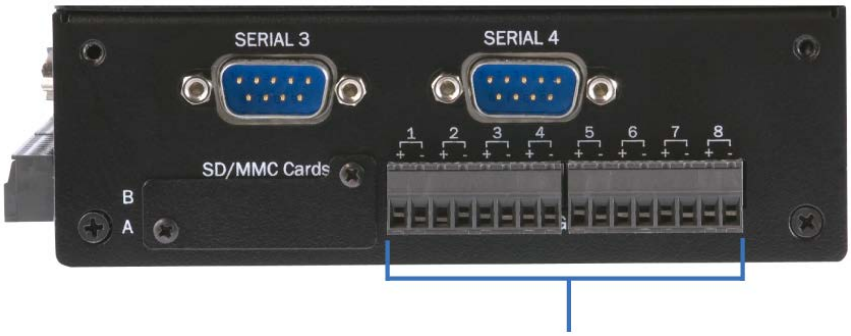
Connector:	OPEN-COLLECTOR OUTPUTS
Manufacturer:	Weco
Part Number:	110-M-111/10
Description:	Terminal Block 10 position 3.5mm spacing
Mates with:	Weco 110-A-111/10 10 position screw-terminal plug (provided)

Pin	Signal
0V	GND
1	Output 1 / PWM1
2	Output 2 / PWM2
3	Output 3 / PWM3
4	Output 4
5	Output 5
6	Output 6
7	Output 7
8	Output 8
Vin	OCVCC



ANALOG INPUTS

The Relio R9 base configuration includes a 12-bit ADC. Software programmable input ranges are 0V to 5V, 0V to 10V, ±5V or ±10V. Interface a variety of transducers and other analog signals via eight 12-bit analog inputs located on the right side of the enclosure. For applications requiring higher resolution, the board can be ordered preconfigured with a 16-bit A/D converter.



Eight 12-bit Analog Inputs

Connector:	ANALOG INPUTS
Manufacturer:	Weco
Part Number:	(2) 110-M-111/08
Description:	(2) Terminal Block 8 position 3.5mm spacing
Mates with:	(2) Weco 110-A-111/08 8 position screw-terminal plugs (provided)

Pin	Signal
1+	AIN1+
1-	AIN1-
2+	AIN2+
2-	AIN2-
3+	AIN3+
3-	AIN3-
4+	AIN4+
4-	AIN4-
5+	AIN5+
5-	AIN5-
6+	AIN6+
6-	AIN6-
7+	AIN7+
7-	AIN7-
8+	AIN8+
8-	AIN8-

QUADRATURE COUNTERS

High-speed input monitoring is accomplished with minimal software overhead using the two onboard 32-bit quadrature counters. Both counters are available on the front of the enclosure, as two connectors labeled "ENCODER". The bottom connector is Quadrature Counter 1, and the top connector is Quadrature Counter 2. Input levels are LVTTL (0 – 3.6VDC).

Two 32-bit Quadrature Counters

Connector:	ENCODER
Manufacturer:	Weco
Part Number:	110-P-211/10
Description:	Terminal Block Dual Stacked 2 X 5 3.5mm
Mates with:	(2) Weco 110-A-111/10 5 position screw-terminal plugs (provided)

QUADRATURE COUNTER 1 (BOTTOM CONNECTOR)

Pin	Signal
A	A
B	B
I	#INDEX
⏚	GND
3.3V	3.3VDC

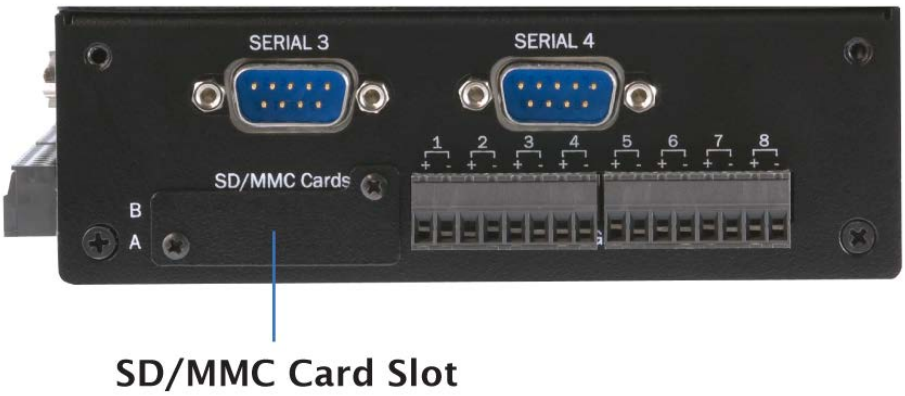
QUADRATURE COUNTER 2 (TOP CONNECTOR)

Pin	Signal
A	A
B	B
I	#INDEX
⏚	GND
3.3V	3.3VDC

SD/MMC CARDS

The Relio R9 provides two SD/MMC Card slots, Slot A and Slot B, located on the right side of the enclosure. Each slot will accept standard-capacity SD/MMC Cards up to 2GB. SD/MMC Card slot A may be used for booting.

To protect the SD/MMC Cards, a cover-plate is provided. To access the SD/MMC Cards, remove the two screws then the cover plate.

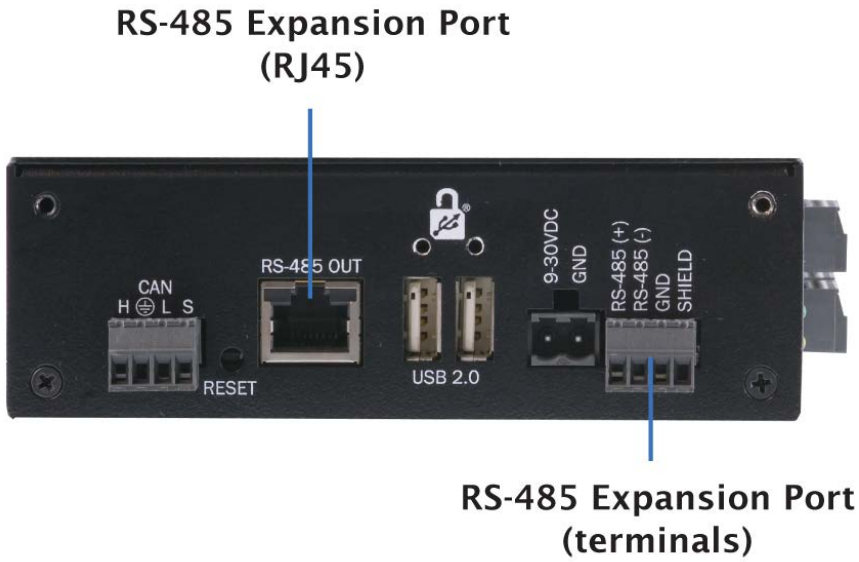


RS-485 EXPANSION

The Relio R9 provides a RS-485 Expansion Port. The port is available on the left side of the enclosure via the RJ-45 connector labeled “RS-485 OUT”, as well as via a 4 pin terminal block.

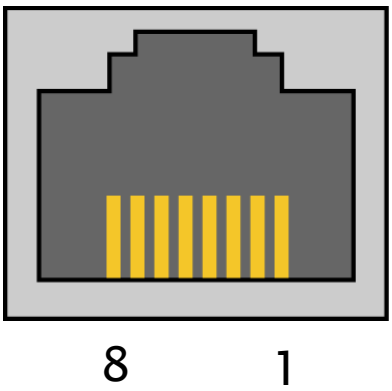
The Relio R9 includes a RS-485 expansion connector on the left side of the unit that is internally connected to the same pins on the screw terminals, also on the left side of the unit. This offers two convenient options for adding additional expansion modules from the Seal/O product line.

The RJ45 port on the left side of the Relio R9 is a RS-485 Expansion Port (labeled “RS-485 OUT”) and is NOT an Ethernet port. Damage to Ethernet networking equipment can result if connected to the RS-485 RJ45 connector.



Connector: RS-485 Expansion (RJ45)
Manufacturer: Xmultiple
Part Number: XRJM-S-01-8-8-F2 or XRJM-S-01-8-8-0
Description: RJ45 Socket, W/O LEDs, Shielded
Mates with: Standard RJ45 Plug

Pin	Signal
1	9-30VDC Source
2	9-30VDC Source
3	Not connected
4	485+
5	485-
6	Not Connected
7	Common (GND)
8	Common (GND)



Connector: RS-485 Expansion
Manufacturer: Weco
Part Number: 110-M-111/04
Description: Terminal Block 4 position 3.5mm spacing
Mates with: Weco 110-A-111/04 4 position screw-terminal plug (provided)

Pin	Signal
RS-485 (+)	485+
RS-485 (-)	485-
GND	Common (GND)
SHIELD	Shield (GND)

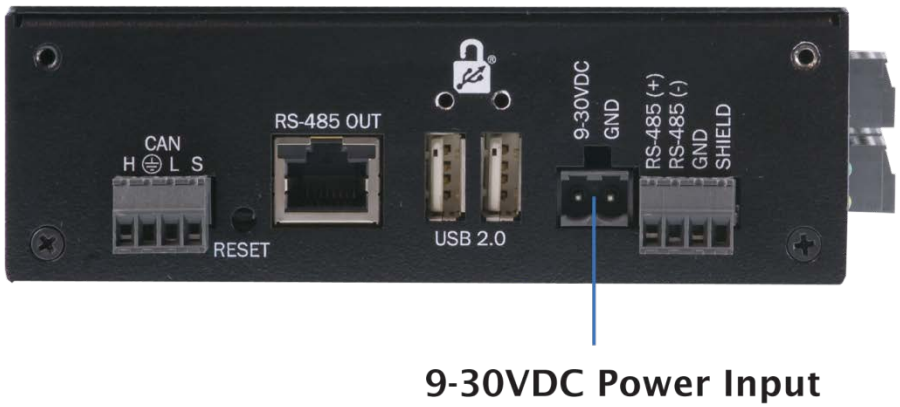
POWER

The Relio-R9 can be powered with the Sealevel TR134.

Connector: 9-30VDC Power Input
Manufacturer: Weco
Part Number: 121-M-111/02
Description: 5.08mm Pitch Friction Lock Header
Mates with: Weco 121-A-111/02

Be sure that you connect the power lead to the proper pin. Reversing the polarity of the power input will damage your SBC-R9.

Pin	Signal
1	9-30VDC
2	GND



9-30VDC Power Input

LED INDICATORS

The SBC-R9 features two LED indicators for power and status. The Green LED (Top) is illuminated when power is applied to the board. The Yellow LED (Bottom) is a GPIO controllable indicator accessible through the TALOS API.

Designator: D9
Description: Dual Stacked LED Indicators

LED	Color	Signal
Top	Green	Power
Bottom	Yellow	Status

Software

RELIO R9 QUICK START

Remove the contents from the box.

Insert the accompanying CD into your PC and run the installation program. This will install Talos Framework binaries, OS Runtime images, documentation, and examples on your PC.(See Figure 1.)

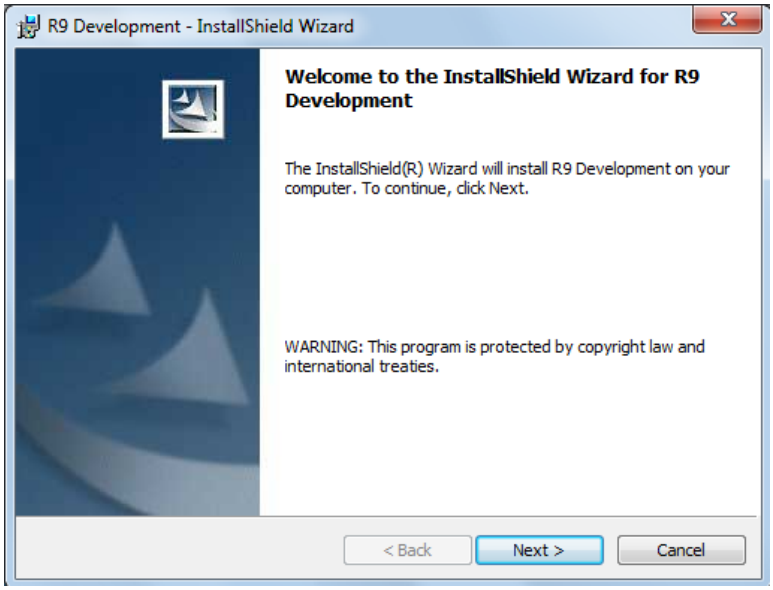

R9 Development - InstallShield Wizard
Welcome to the InstallShield Wizard for R9 Development
The InstallShield(R) Wizard will install R9 Development on your computer. To continue, click Next.
WARNING: This program is protected by copyright law and international treaties.
< Back
Next >
Cancel

Figure 1. Installation Wizard

After installation, the package can be found in Windows by clicking Start → All Programs → Sealevel Systems → R9 Development.

Verify that the accompanying SD Card (located in SD/MMC Card Slot A of the Relio R9) is correctly inserted. The contents of the SD Card will allow the Relio R9 to run Windows CE 6.0 OS when power is applied to the board.

To avoid accidental damage, be sure to follow proper ESD procedures by grounding yourself and the board.

To avoid accidental damage, be sure to observe proper power connector polarity. See Power Pin-out section.

Apply power to the Relio R9 by connecting the TR123 tinned leads to the Relio R9 input power connector screw terminals, noting proper polarity. Attach the other end of the TR123 into a 120VAC wall outlet.

Use a standard USB device cable and connect the Type B connector to the Relio R9. Connect Type A connector into the host PC. *(See Figure 2.)*

Figure 2. TR123 tinned leads and Type B USB connector.

You are now ready to set up a USB communication interface between the host PC and the Relio R9 board. Depending on which operating system you are using – Windows 7, Vista, or XP – the setup experience will vary.

WINDOWS DEVICE CENTER

If your host PC is running Windows Vista or later and you are connected to the Internet, then Windows Mobile Device Center software will install automatically. If you are not connected to the Internet but have obtained the Mobile Device Center software manually, then running their setup will achieve the same result. (See Appendix A.)

After installation, a negotiation will begin between the PC and the Relio R9 board and the device center connection screen will appear. (See Figure 3.)

Windows Mobile Device Center
Home
Windows Mobile
Set up your device
Get Outlook contacts, calendar, e-mail and other information on your device.
Connect without setting up your device
Connected

Figure 3. Device Center connected screen

Using your mouse, click "Connect without setting up your device". The idea is to explore the file system on the Relio R9 without setting up synchronization with contacts, calendar, or e-mail. Now choose "File Management → Browse the contents of your device" from the screen. (See Figure 4.)

Figure 4. Device Center File Management

This action opens a standard Windows Explorer where the default file contents of the Relio R9 can be read or written to. (See Figure 5.)

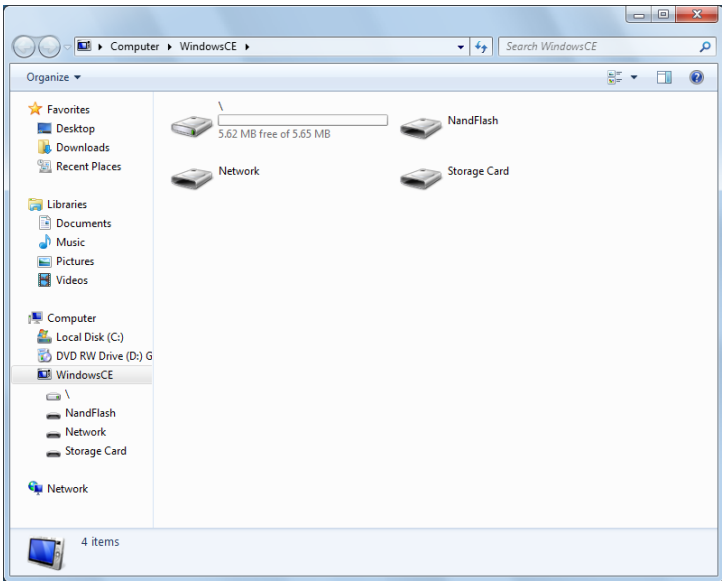


Figure 5. Contents of Relio R9

WINDOWS ACTIVESYNC FOR XP

If your host PC is running Windows XP, ActiveSync is required to establish connection to the Relio R9. ActiveSync differs from Mobile Device Center in that having an internet connection will not establish an automatic download and installation. For installation procedures, refer to Microsoft's website. (See Appendix A). After installation, a negotiation will begin between the PC and the Relio R9 board, and the "New Partnership" dialog will appear. (See Figure 6.)

New Partnership
Set Up a Partnership
Before you can synchronize information between your mobile device and this computer, you must set up a partnership between them.
Would you like to set up a partnership?
Yes
Set up a partnership so that I can synchronize information between my device and this computer.
No
I don't want to synchronize information. Set up my device as a guest so that I can copy or move information between my device and this computer.
< Back
Next >
Cancel
Help

Figure 6. ActiveSync New Partnership screen

Using your mouse, select “No” and then select “Next”. The ActiveSync main dialog will appear. Click the “Explore” icon. This action opens a standard Windows Explorer where the default file contents of the Relio R9 can be read or written. (See Figure 7.)

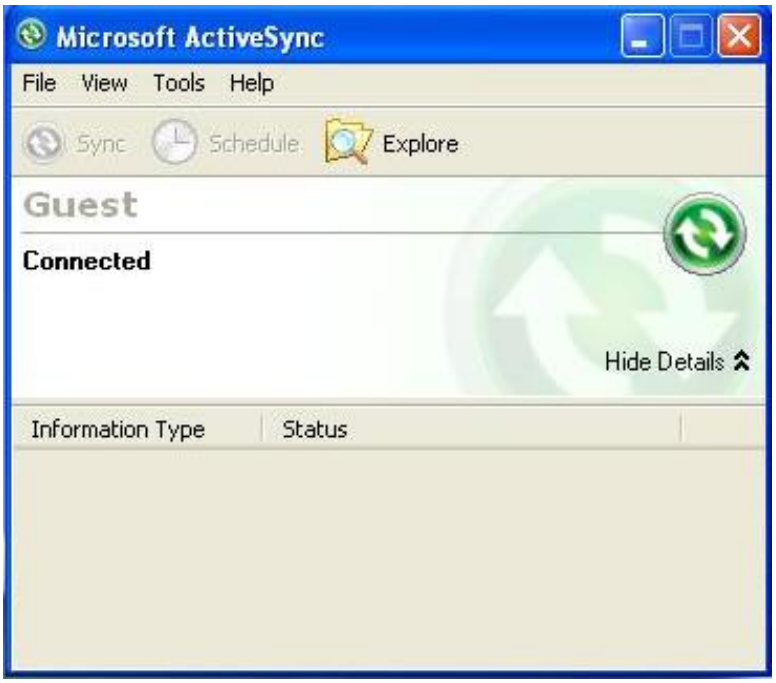


Figure 7. ActiveSync Main Dialog screen

CONNECTION COMPLETE

You are now ready to set up a complete development environment for building and debugging smart device applications and libraries. The next section guides you by example using Microsoft Visual Studio.

APPLICATION DEVELOPMENT

INTRODUCTION

With .NET Compact Framework coupled with our Talos .NET Framework, C# and VB.NET programmers can develop powerful embedded applications on the Relio R9 such as mobile, robotics, home automation, industrial, and a broad range of other embedded applications. The low cost of licensing for Windows 6.0 CE has created an ideal environment to develop a new generation of embedded products around the Relio R9.

Our Talos Framework allows access to the more specific I/O sections of the Relio R9 development board such as analog and digital I/O points, CAN bus, quadrature counter inputs, and the multi-electrical interface serial ports. A complete list of the API documentation can be found either in Windows by clicking Start → All Programs → Sealevel Systems → R9 Development → Talos Documentation.html.

Writing .NET applications for the Relio R9 is very similar to writing desktop or console applications for Windows XP, Vista, and 7. The only difference is the amount of resources available. Because the memory footprint is smaller compared to a desktop computer, care should be taken where allocation of memory is concerned, such as large object creation.

REQUIREMENTS

- Visual Studio Professional 2005 or 2008
- .NET Compact Framework 3.5

GETTING STARTED

For this demonstration, we will construct a smart device console application using Visual C#. Start Visual Studio and select File → New → Project. A 'New Project' dialog will appear. Select a project type of Visual C# → Smart Device. Select 'Smart Device Project' as the Template. Make sure the combo box has .NET Framework 3.5 selected. Type the name of the project. In this case, call it *HelloWorld*. (See Figure 8.)

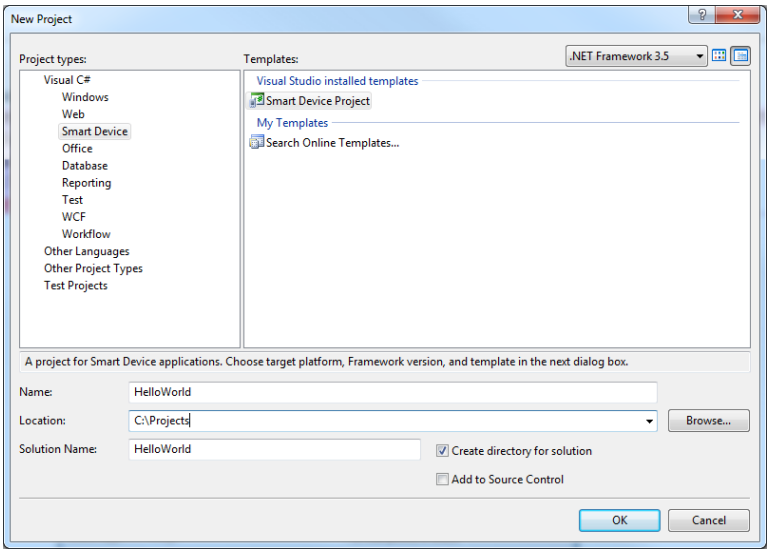


Figure 8. Visual Studio New Project dialog

Click the "OK" button. The next configuration screen allows you to select the type of project you are creating. Select "Windows CE" for the target platform, .NET Compact Framework version 3.5 and select the "Console Application" icon for the template. (See Figure 9.)

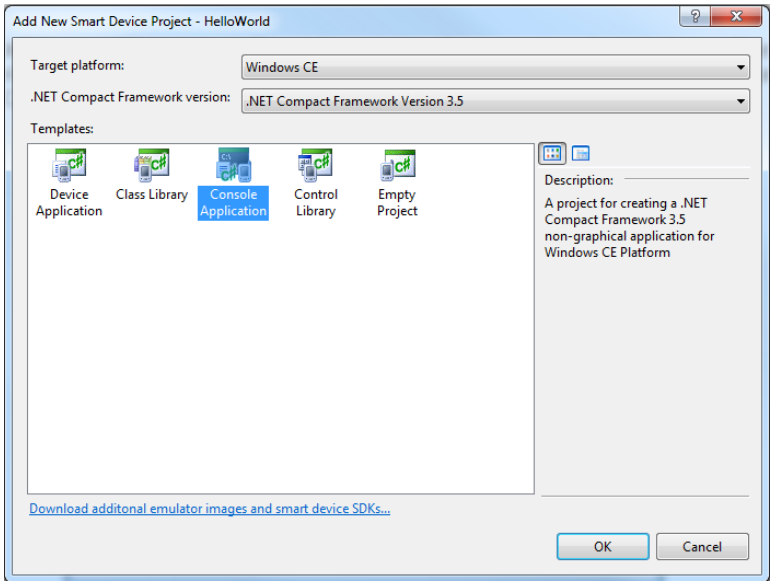


Figure 9. Visual Studio Add Smart Device dialog

Once you have selected all of the configuration options, click the "OK" button. You will now see a console application template called *HelloWorld* in Visual Studio. (See Figure 10.)

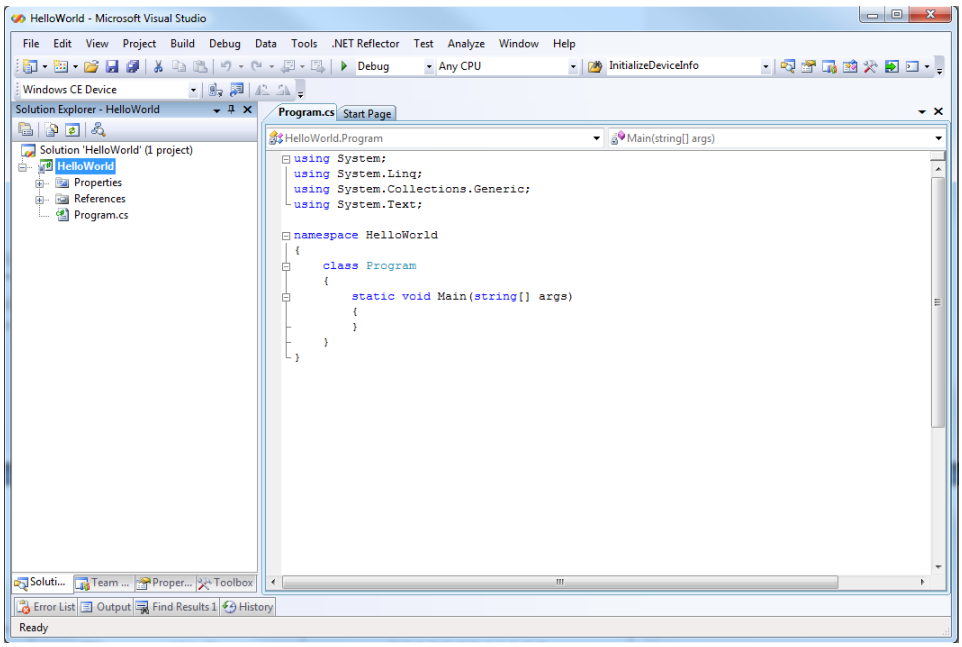


Figure 10. Visual Studio Main Window

We can now add the references to the Talos Framework. Right click on the “References” and select the "Add Reference…" selection. (See Figure 11.)

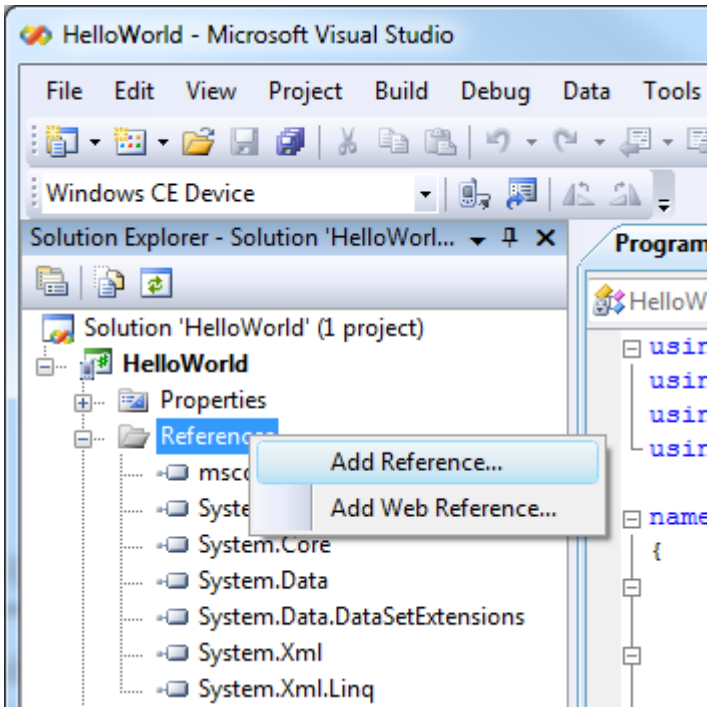


Figure 11. Adding References to Project

An ‘Add Reference’ dialog will appear. Click on the ‘Browse’ tab then search for the installed library path “C:\Program Files\Sealevel Systems\R9 Development\Assemblies”. If you don’t see a list of the R9 libraries as shown in Figure 12, then refer to the Relio R9 QuickStart section for software installation details. While holding down the CTRL key, click on both "SLCorLib.dll" and "Talos.dll". Click the “OK” button. (See Figure 12.)

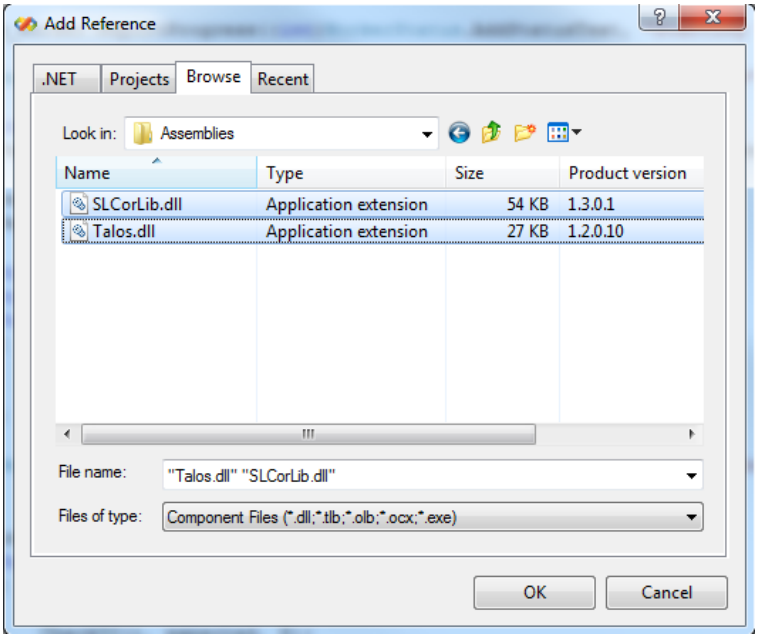


Figure 12. Core library reference

Both DLLs should appear in your “References” list. (See Figure 13.)

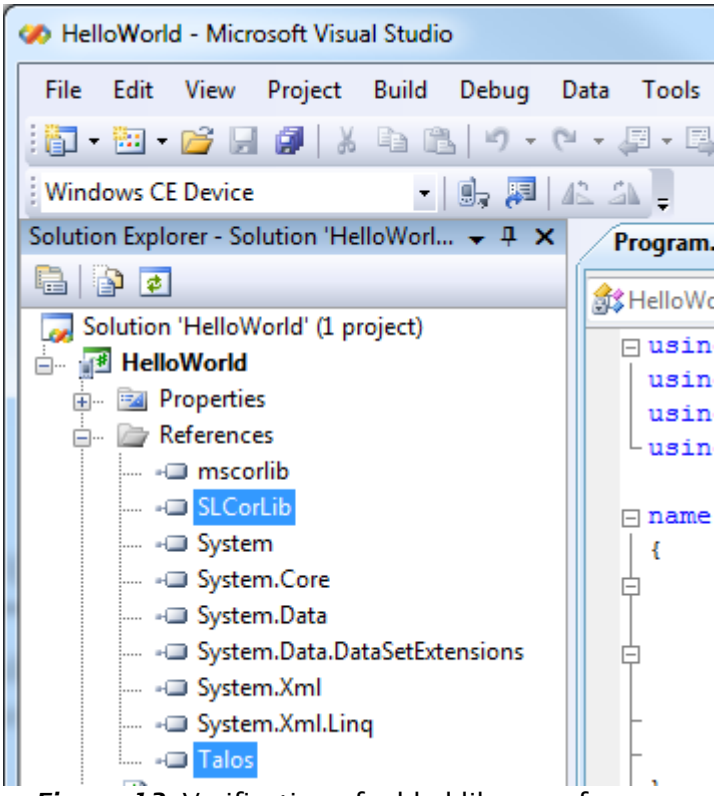


Figure 13. Verification of added library references

Now that the Talos Framework has been referenced, you have access to all the I/O points exposed on the Relio R9 device.

For this simple HelloWorld application, we will just echo the string “Hello World” in the console window. This can be accomplished by adding the following code to the automatically created Program::Main() method. This code will echo “Hello World” and then pause for 5 seconds.

```
static void Main(string[] args)
{
      Console.WriteLine("Hello World");
      System.Threading.Thread.Sleep(5000);
}
```

From Visual Studio’s menu bar, select “Build → Build HelloWorld”. After the build process has completed select from the same menu bar, “Build → Deploy HelloWorld”. A “Deploy HelloWorld” dialog will appear for you to choose the appropriate target. Choose “Windows CE Device” then press the ‘Deploy’ button. (See Figure 14.)

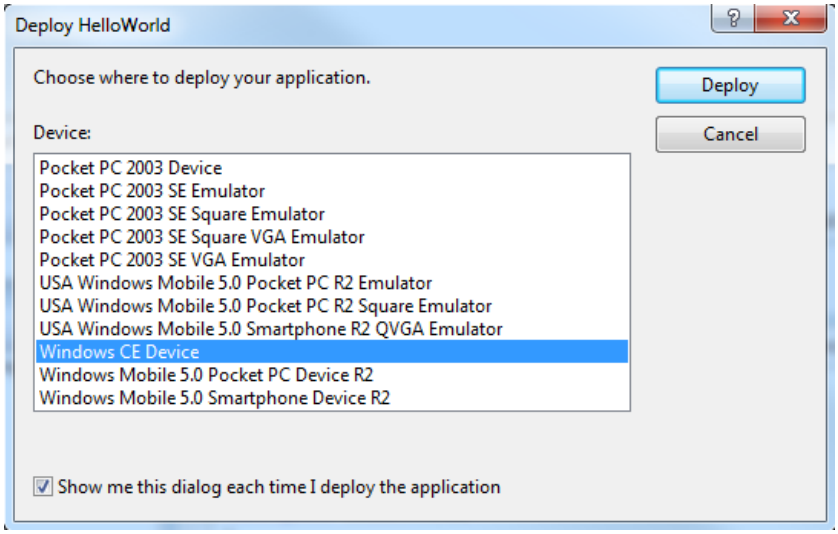

Deploy HelloWorld
Choose where to deploy your application.
Deploy
Device:
Cancel
Pocket PC 2003 Device
Pocket PC 2003 SE Emulator
Pocket PC 2003 SE Square Emulator
Pocket PC 2003 SE Square VGA Emulator
Pocket PC 2003 SE VGA Emulator
USA Windows Mobile 5.0 Pocket PC R2 Emulator
USA Windows Mobile 5.0 Pocket PC R2 Square Emulator
USA Windows Mobile 5.0 Smartphone R2 QVGA Emulator
Windows CE Device
Windows Mobile 5.0 Pocket PC Device R2
Windows Mobile 5.0 Smartphone Device R2
Show me this dialog each time I deploy the application

Figure 14. Choose Windows CE Device and Deploy

After the deployment phase the “Hello World” message will appear on the Debug Serial console output.

Examples can be found from the installation directory under ‘..\R9 Development\Samples\C#’ and ‘..\R9 Development\Samples\VB.NET’.

APPLICATION DEBUGGING

INTRODUCTION

This guide details the process of debugging an application developed for the Relio R9 embedded IO system. The Relio R9 development platform easily integrates into standard Microsoft development tools to make the debugging process extremely easy. The following sections detail the requirements to begin debugging an application on Microsoft Windows 7, Vista, or XP.

REQUIREMENTS

- Microsoft Mobile Device Center using Vista or ActiveSync using XP
- Microsoft Visual Studio Professional 2005 or 2008
- USB Cable or Ethernet connection

Debugging your Relio R9 applications is a simple process that requires a USB cable or Ethernet connection, Microsoft device synchronization software, and Visual Studio. Depending on your version of Windows, you will need to follow a different process to install the device synchronization software as outlined in the Relio R9 Quick Start section.

DEBUGGING AN APPLICATION

Once the Relio R9 has been successfully attached to your PC, it is easy to begin debugging an application on the Relio R9. This section will demonstrate how to attach the Microsoft Visual Studio debugger to the Relio R9, show the use of breakpoints in the debugger, and show how to access useful information while debugging an application.

We will be using the GPIO example application found in the "samples" directory of the Talos Framework installation. The same methods will apply to any application you wish to debug on the Relio R9.

ATTACH THE DEBUGGER

Once your solution is opened, it is necessary to specify the device target that you would like to use in conjunction with the debugger. The default option is an emulator. Select "Windows CE Device" from the target device drop down. (See Figure 15.)

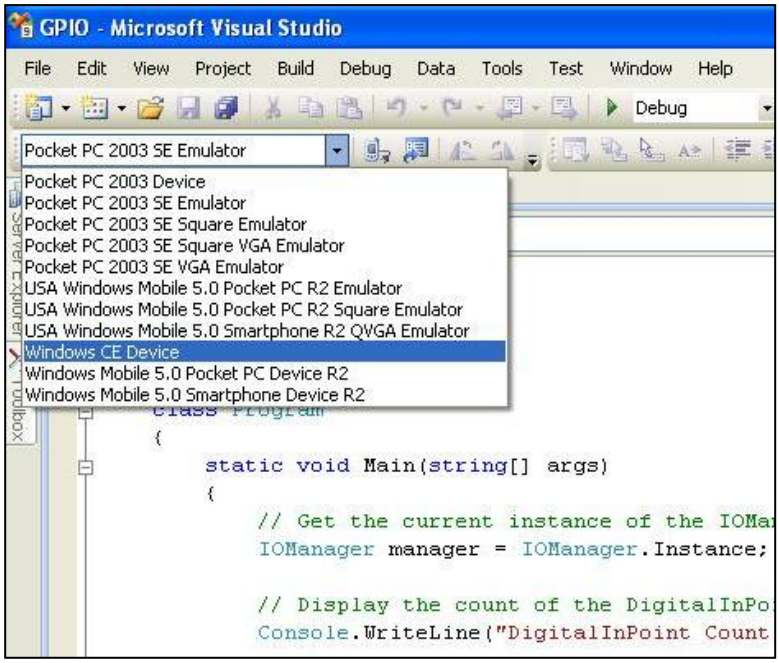

GPIO - Microsoft Visual Studio
File Edit View Project Build Debug Data Tools Test Window Help
Debug
Pocket PC 2003 SE Emulator
Pocket PC 2003 Device
Pocket PC 2003 SE Emulator
Pocket PC 2003 SE Square Emulator
Pocket PC 2003 SE Square VGA Emulator
Pocket PC 2003 SE VGA Emulator
USA Windows Mobile 5.0 Pocket PC R2 Emulator
USA Windows Mobile 5.0 Pocket PC R2 Square Emulator
USA Windows Mobile 5.0 Smartphone R2 QVGA Emulator
Windows CE Device
Windows Mobile 5.0 Pocket PC Device R2
Windows Mobile 5.0 Smartphone Device R2
{
static void Main(string[] args)
{
// Get the current instance of the IOMa
IOManager manager = IOManager.Instance;
// Display the count of the DigitalInPo
Console.WriteLine("DigitalInPoint Count

Figure 15. Device Target Selection

If you would like to use the faster Ethernet connection for debugging instead of the USB connection, refer to Appendix C – Application Debugging over Ethernet.

Now select the “Connect to Device” icon to initiate synchronization between Visual Studio and the Relio R9 device. (See Figure 16.)

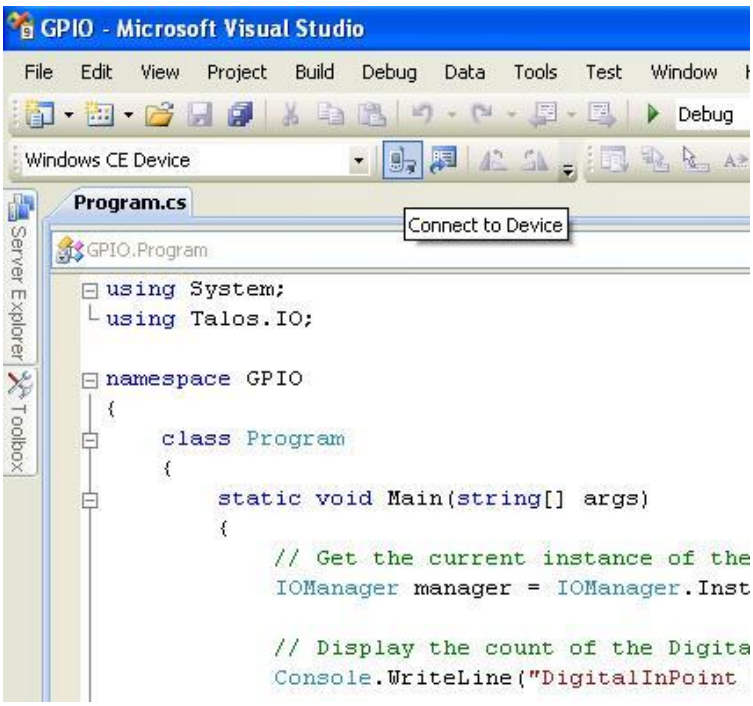


Figure 16. Connect to Device icon

You should now see a connection dialog appear. (See Figure 17.)

Figure 17. Connection Status Dialog

BREAKPOINTS

Setting breakpoints allows you to stop execution of your application at any point and examine the state of the application. A breakpoint may be set by selecting a line and pressing the "F9" hotkey. (See Figure 18.)

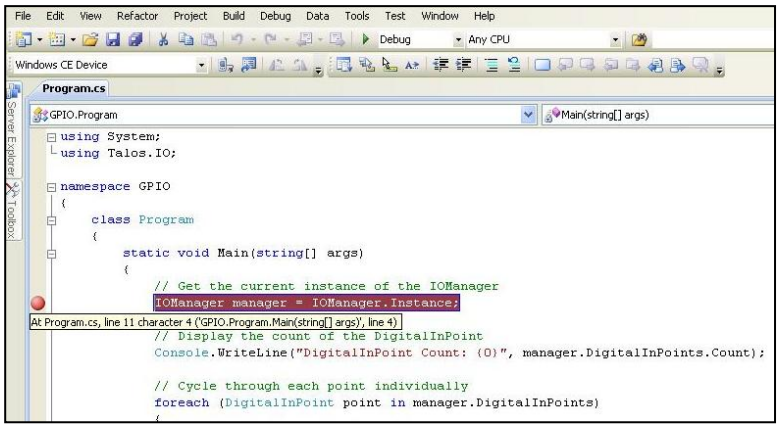


Figure 18. Breakpoint selection

To begin debugging the application, click the "Start Debugging" button. (See Figure 19.)

Figure 19. Run Debugger icon

Although you previously set up the target device, upon starting the first debug session, you will be prompted to select the device to deploy the application to. Select the "Windows CE Device" as was done earlier when selecting the target. (See Figure 20.)

Deploy GPIO
Choose where to deploy your application.
Deploy
Cancel
Device:
Pocket PC 2003 Device
Pocket PC 2003 SE Emulator
Pocket PC 2003 SE Square Emulator
Pocket PC 2003 SE Square VGA Emulator
Pocket PC 2003 SE VGA Emulator
USA Windows Mobile 5.0 Pocket PC R2 Emulator
USA Windows Mobile 5.0 Pocket PC R2 Square Emulator
USA Windows Mobile 5.0 Smartphone R2 QVGA Emulator
Windows CE Device
Windows Mobile 5.0 Pocket PC Device R2
Windows Mobile 5.0 Smartphone Device R2
Show me this dialog each time I deploy the application

Figure 20. Target Deployment dialog

Once the application is deployed to the Relio R9, it will begin execution. As soon as the first breakpoint is reached, execution will cease and you will gain full control over the running application. You may use the debugging options to continue execution, execute a single line, or execute multiple lines. You may view the status of each variable by either hovering over it with the cursor or by examining the windows at the bottom of Visual Studio just as you would with a desktop application. (See Figure 21.)

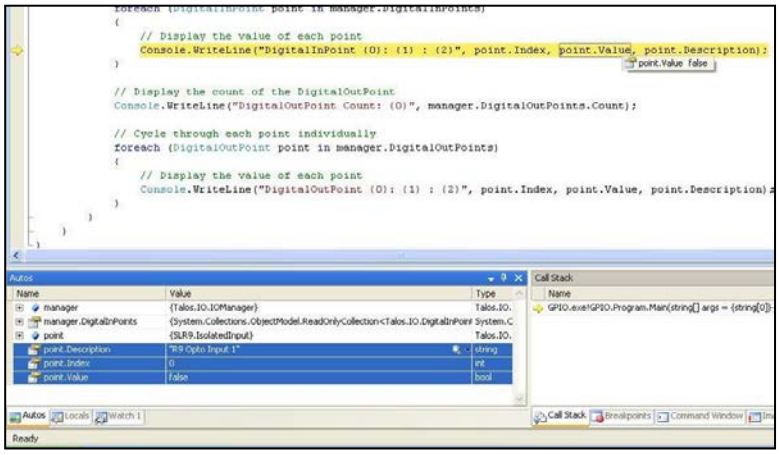


Figure 21. Examining program variables

WATCHING VARIABLES

When program execution is halted due to a break point condition being met, the debugger will display the state of all local variables. In addition to those variables, class specific variables can be grouped together as a view to aid in debugging your application. This is accomplished by right clicking on a variable and selecting "Add Watch". Each addition appends a tab to the “Watch n” window where n is incremented for each variable added. (See Figure 22.) Each watch window provides a convenient tree type structure for viewing hierarchical class variables.

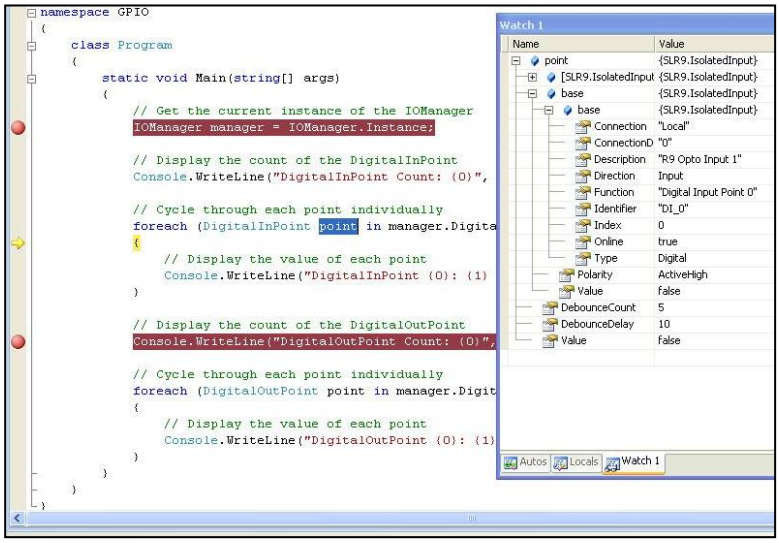


Figure 22. Watch view

TARGET DEPLOYMENT AND EXECUTION

After your application is built using Visual Studio, either a debug or release executable, it may be desirable to copy it onto the SDCARD or NAND Flash. This would provide a means to store and execute your application without the need for connectivity to a host computer. The first step is transferring your application to a suitable directory on the SDCARD or on-board NAND Flash. To accomplish this you will need to establish connectivity via Mobile Device Center or ActiveSync as outlined in the Relio R9 Quick Start section above.

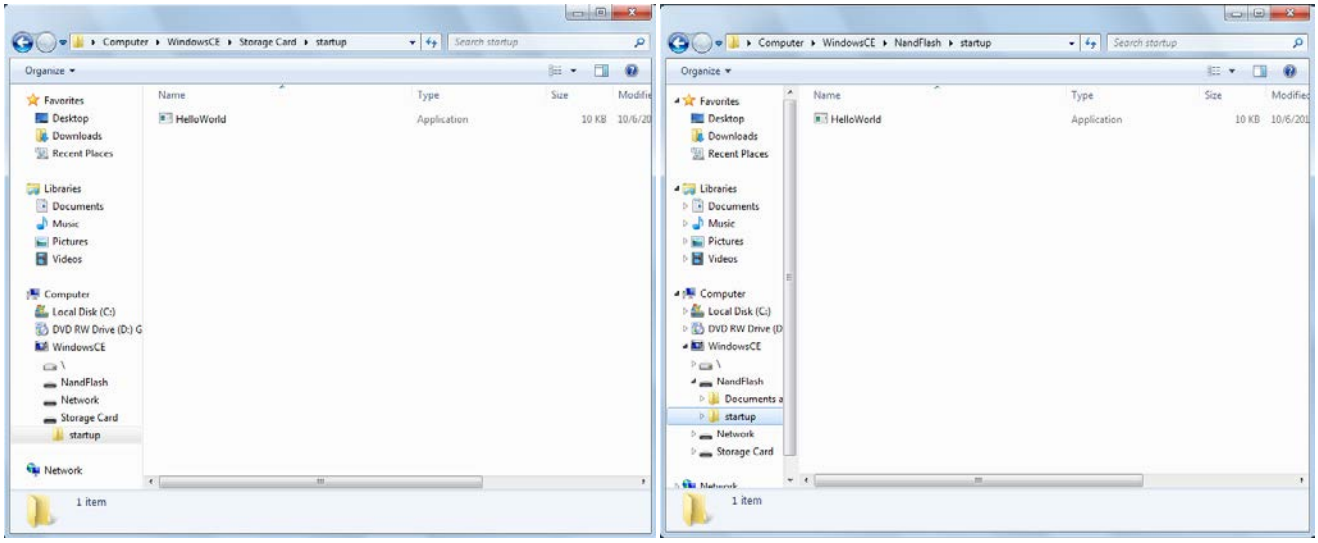


Figure 23. Application Placement

The Relio R9 Runtime image comes pre-loaded with a utility program called "SpringBoard". This utility provides a solution for automatically running your applications at startup. Rather than copying your application files to '/Windows/Startup/' - which is in volatile memory - the executables should be copied to '/Storage Card/startup/' or `/nandflash/startup/'. After Windows CE runs, SpringBoard automatically starts applications located in the NAND Flash followed by applications in the Storage Card.

SpringBoard also provides a way to specify program arguments by supplying an XML configuration file. You will need to create a simple XML file called "startup.xml". This XML file should consist of an element list each with an application name and the desired arguments for that application. (See Figure 24.) This file must reside in the following location: '/storage card/startup/startup.xml' and/or '/nandflash/startup/startup.xml'.

If the startup.xml file is not found or is not desired, SpringBoard will still automatically run all the applications placed in the aforementioned directory structure, only no arguments will be included for those applications.

```
<?xml version="1.0" encoding="utf-8" ?>
 <programs>
  <program name="sample1.exe" arguments="/i 1019 /w JSmith" />
  <program name="sample2.exe" arguments="-e 2000" />
  <program name="sample3.exe" arguments="/help" />
</programs>
```

Figure 24. startup.xml

SDCARD BOOT SEQUENCE

Upon power up, the Relio R9 follows a specific boot sequence. The initial sequence is "firstboot". The firstboot process initializes the low level hardware and is responsible for loading the next sequence called "eboot". Eboot provides a configuration menu for setting connection types and start up memory locations. Connection types include Ethernet and USB. Memory locations include SDCARD and NAND Flash. Ultimately, eboot attempts to load and execute the OS runtime image based on those configuration settings.

The Relio R9 development board checks the root directory of the bottom SDCARD for a valid Eboot boot loader (boot.bin). The file must be named boot.bin and the SDCARD must be formatted as FAT 12/16/32. If no boot image is found, the device will next check the raw data in the NAND Flash.

Only the bottom SDCARD slot (Slot A) or NAND Flash can be used for booting to an OS runtime image.

The Relio R9 ships with an SDCARD loaded with the OS files listed below:

- Boot.bin
- Eboot.bin
- NK.bin

OS FILE RESTORATION

In the event that Sealevel produces updated OS file versions or a backup is desired, the OS files will need to be copied to the root directory of an SDCARD or programmed to the NAND Flash. There are a variety of ways to copy files to the SDCARD; please see the section labeled "Upgrading the OS runtime image on SDCARD" below for more detail. Please see the section labeled "Upgrading the OS runtime image on NAND Flash" for further detail into that process. The NAND Flash cannot be programmed until any existing OS runtime image has been removed and the SDCARD is removed or the OS image on it is removed.

USING THE DEBUG PORT

This procedure requires an available RS-232 COM port or USB to RS-232 serial port adapter attached to a host PC, a Relio R9 Serial Debug cable (Item# CA429), and any telnet terminal client application such as PuTTY (See Appendix A). For this procedure, we will demonstrate the use of PuTTY.

Connect the 4-pin keyed female end of the Relio R9 RS-232 cable into the Relio R9 connector (J6). To access this connector you will need to remove the cover of the Relio R9 and locate the connector on the exposed motherboard. Connect the DB9 end of the Relio R9 RS-232 cable into an available serial port on the host PC.

Run PuTTY and select “Serial” from the Category section of the dialog. Identify the proper COM port number and always assign the speed (baud) equal to 115200. Set Data bits to 8, Stop bits to 1, Parity to None, and Flow control to None. (See Figure 25.)

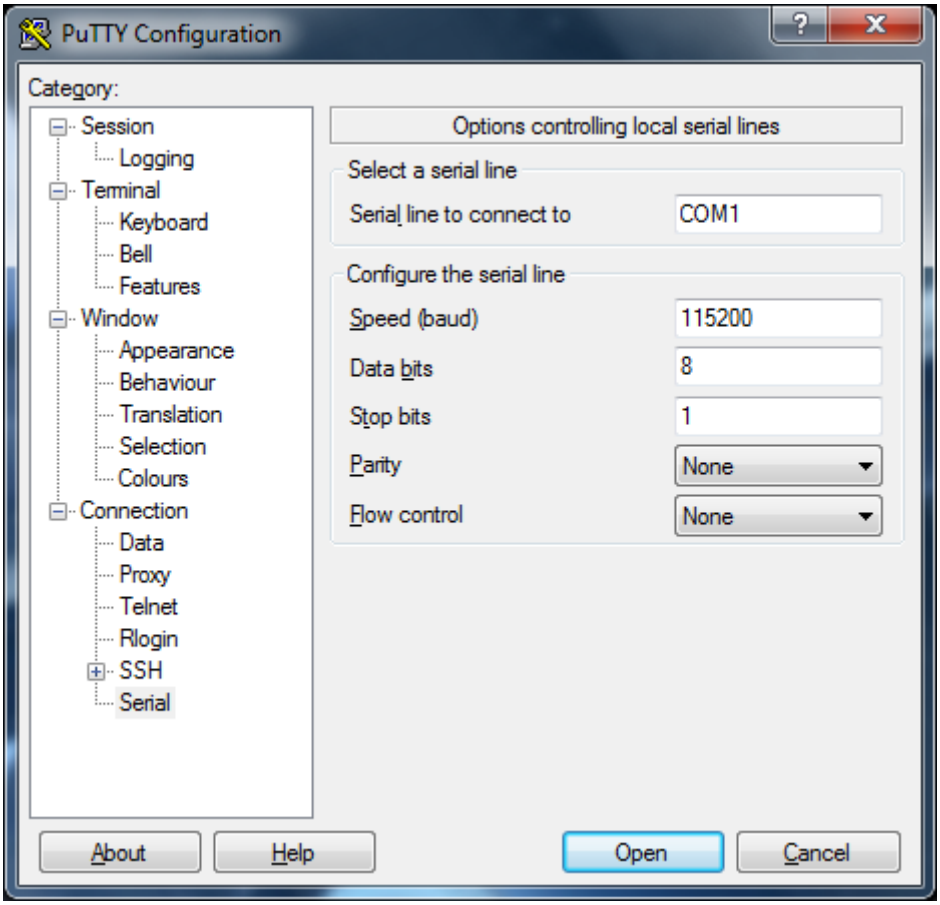


Figure 25. PuTTY Serial configuration

Select “Session” from the Category section of the dialog. A saved session of this configuration can be performed to avoid reconfiguration in the future. Next select Serial for the connection type. Type a name for this session under “Saved Sessions”, then press the “Save” button. (See Figure 26.)

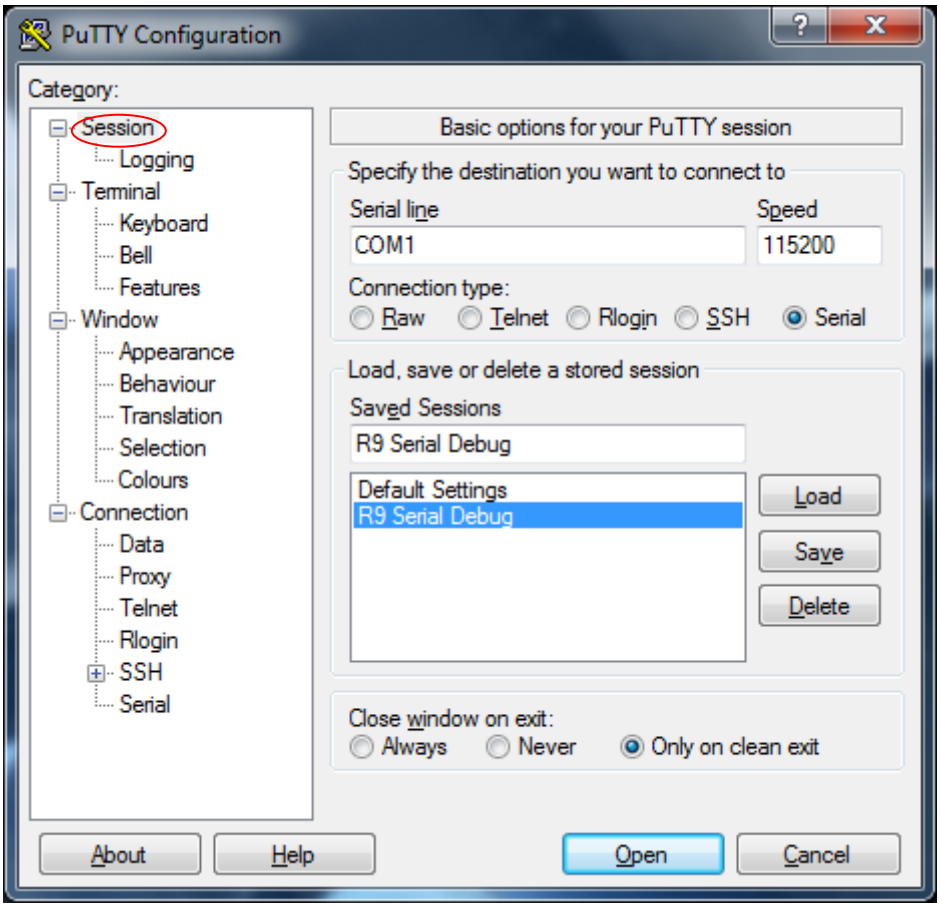


Figure 26. PuTTY Session configuration

Press “Open” to start a new terminal session. A blank terminal window will appear. Debug messages may not appear until power is applied to the Relio R9 board. Press the reset button on the Relio R9 to display the Ethernet boot loader configuration screen. (See Figure 27.) When the unit boots, the following menu on the debug port terminal will appear (no user input is required for booting):

```
“Press [ENTER] to download now or [SPACE] to cancel.
Initiating image download in 2 seconds"
```

Once the prompt period expires, the OS runtime will be loaded from SDCARD or NAND Flash (depending on boot sequence and boot files available) into RAM and executed. At this point, the OS is running and all console output is redirected to the debug serial port. (See Figure 27.)

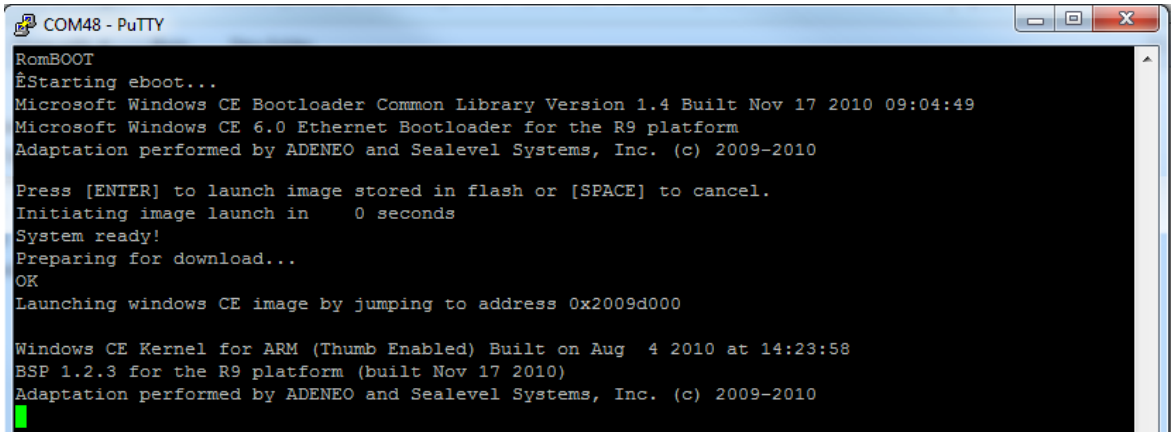

COM48 - PuTTY
RomBOOT
ÊStarting eboot...
Microsoft Windows CE Bootloader Common Library Version 1.4 Built Nov 17 2010 09:04:49
Microsoft Windows CE 6.0 Ethernet Bootloader for the R9 platform
Adaptation performed by ADENEO and Sealevel Systems, Inc. (c) 2009-2010
Press [ENTER] to launch image stored in flash or [SPACE] to cancel.
Initiating image launch in 0 seconds
System ready!
Preparing for download...
OK
Launching windows CE image by jumping to address 0x2009d000
Windows CE Kernel for ARM (Thumb Enabled) Built on Aug 4 2010 at 14:23:58
BSP 1.2.3 for the R9 platform (built Nov 17 2010)
Adaptation performed by ADENEO and Sealevel Systems, Inc. (c) 2009-2010

Figure 27. Application Debug Text Output

Eboot configuration settings can be modified by hitting the “space” key during the 2 second boot prompt period. When modifying the configuration, a menu such as the one below is displayed. (See Figure 28.)

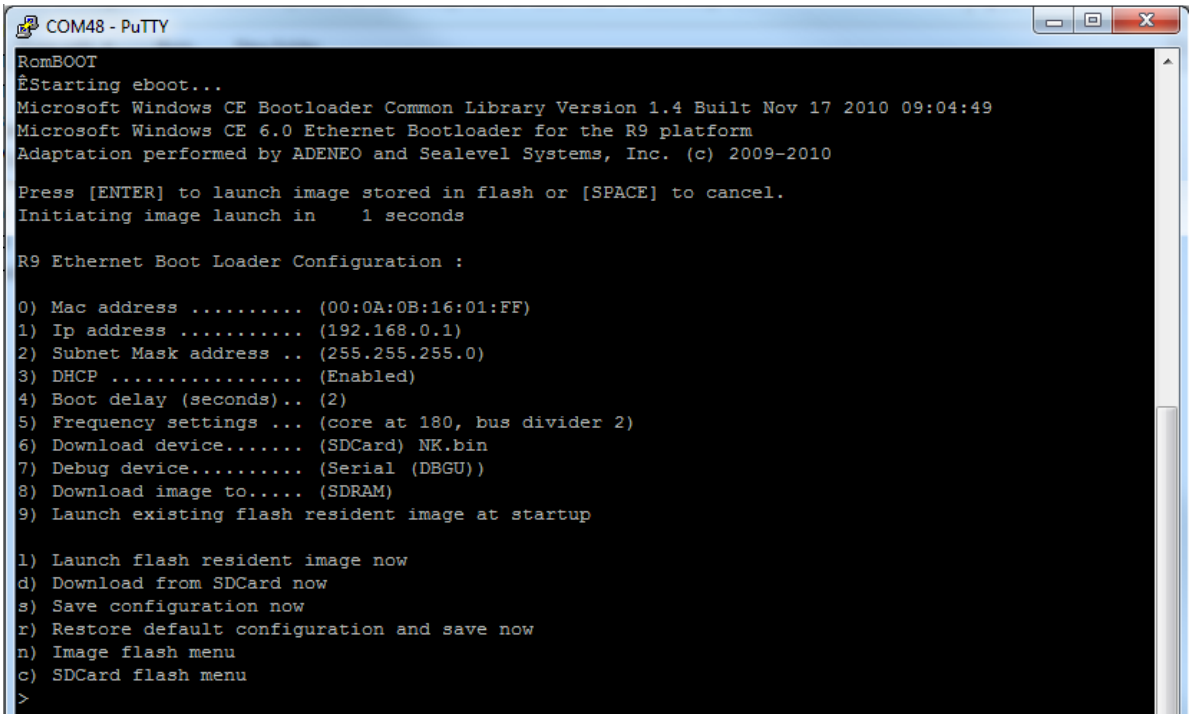

COM48 - PuTTY
RomBOOT
ÊStarting eboot...
Microsoft Windows CE Bootloader Common Library Version 1.4 Built Nov 17 2010 09:04:49
Microsoft Windows CE 6.0 Ethernet Bootloader for the R9 platform
Adaptation performed by ADENEO and Sealevel Systems, Inc. (c) 2009-2010
Press [ENTER] to launch image stored in flash or [SPACE] to cancel.
Initiating image launch in 1 seconds
R9 Ethernet Boot Loader Configuration :
0) Mac address ..... (00:0A:0B:16:01:FF)
1) Ip address ..... (192.168.0.1)
2) Subnet Mask address .. (255.255.255.0)
3) DHCP ..... (Enabled)
4) Boot delay (seconds).. (2)
5) Frequency settings ... (core at 180, bus divider 2)
6) Download device..... (SDCard) NK.bin
7) Debug device..... (Serial (DBGU))
8) Download image to..... (SDRAM)
9) Launch existing flash resident image at startup
l) Launch flash resident image now
d) Download from SDCard now
s) Save configuration now
r) Restore default configuration and save now
n) Image flash menu
c) SDCard flash menu
>

Figure 28. Eboot configuration output

Modifying any of these settings may render your Relio R9 unbootable.

When upgrading an existing OS runtime stored in the NAND Flash, it is necessary to first erase the NAND Flash of a pre-programmed unit. This is accomplished through the "Image flash menu" ('n' key) in Eboot. The flash menu has an option to "Erase all sectors" of the NAND Flash ('1' key). (See Figure 29.)

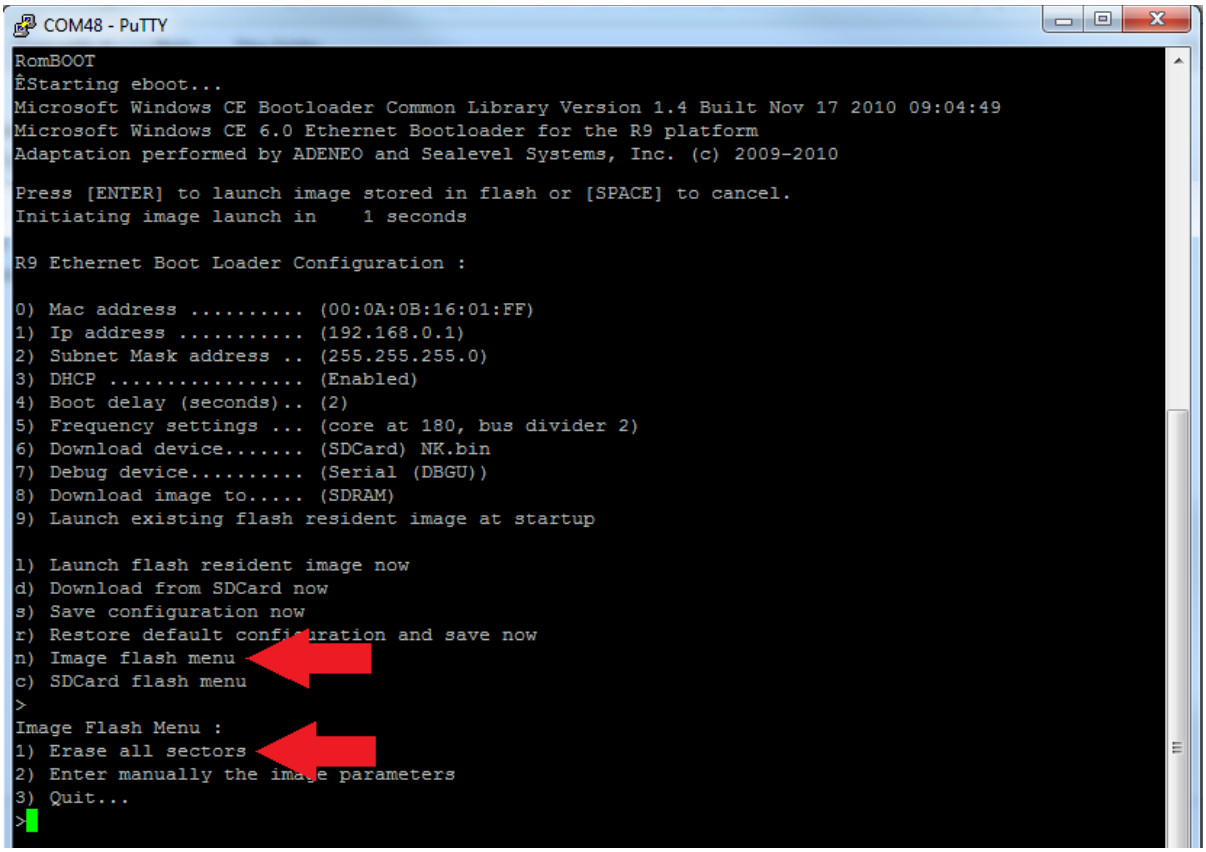

COM48 - PuTTY
RomBOOT
ÊStarting eboot...
Microsoft Windows CE Bootloader Common Library Version 1.4 Built Nov 17 2010 09:04:49
Microsoft Windows CE 6.0 Ethernet Bootloader for the R9 platform
Adaptation performed by ADENEO and Sealevel Systems, Inc. (c) 2009-2010
Press [ENTER] to launch image stored in flash or [SPACE] to cancel.
Initiating image launch in 1 seconds
R9 Ethernet Boot Loader Configuration :
0) Mac address ..... (00:0A:0B:16:01:FF)
1) Ip address ..... (192.168.0.1)
2) Subnet Mask address .. (255.255.255.0)
3) DHCP ..... (Enabled)
4) Boot delay (seconds).. (2)
5) Frequency settings ... (core at 180, bus divider 2)
6) Download device..... (SDCard) NK.bin
7) Debug device..... (Serial (DBGU))
8) Download image to..... (SDRAM)
9) Launch existing flash resident image at startup
l) Launch flash resident image now
d) Download from SDCard now
s) Save configuration now
r) Restore default configuration and save now
n) Image flash menu
c) SDCard flash menu
>
Image Flash Menu :
1) Erase all sectors
2) Enter manually the image parameters
3) Quit...
>

Figure 29. Eboot Image Flash Menu

The "Erase all sectors" option in Eboot will erase the entire NAND Flash, so be sure to back up any data you wish to save before attempting to erase the device.

UPGRADING THE OS RUNTIME IMAGE ON SDCARD

Factory OS runtime images are stored in the "Boot Files" directory of the R9 Development installation (see Quick start guide). There a few ways to upgrade the OS runtime image (*.bin) located on your bootable SDCARD:

- a memory card reader (preferred method)
- USB connection with Windows Mobile Device Center or ActiveSync
- FTP connection.

MEMORY CARD READER

When inserting the SDCARD into your memory card reader, you may be prompted with an "AutoPlay" option. Choose "Open folder to view files". If the "AutoPlay" feature has been disabled, navigate to the memory card reader manually. (See Figure 30).

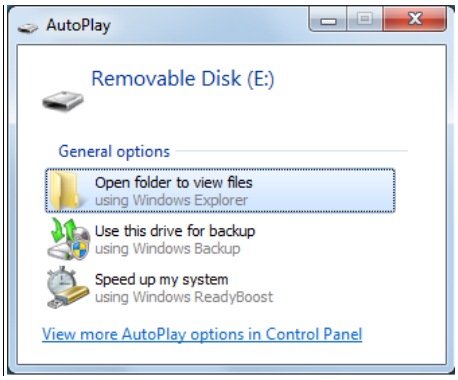


Figure 30. AutoPlay screen

The OS runtime image consists of three binary (.bin) files as demonstrated below. (See Figure 31).

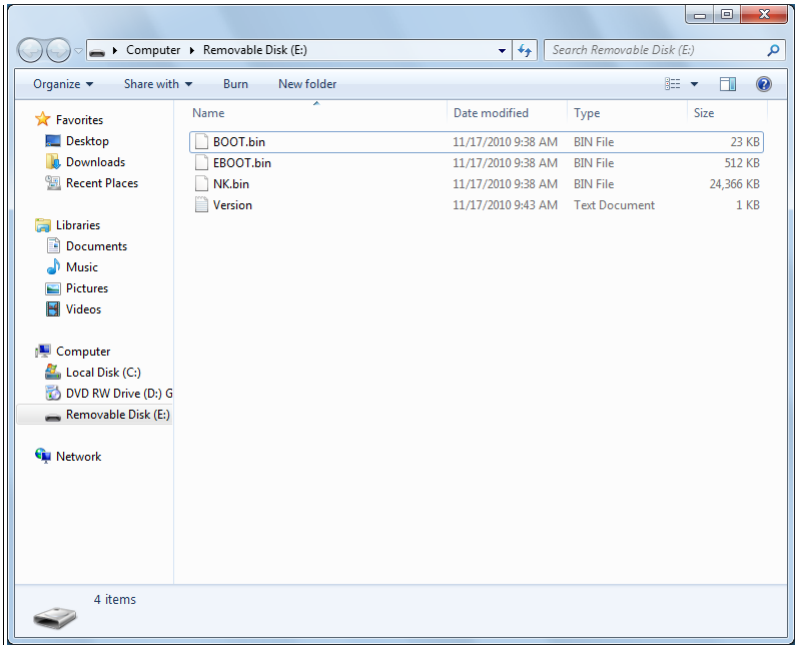


Figure 31. SDCARD File Contents

To save the existing OS runtime image, backup the files previously stored on the SDCARD.

Copy the new OS runtime image to the SDCARD. A popup will appear asking you to override your current files. Select the "Copy and Replace" option to over-write the existing OS runtime image. The new OS runtime image will be loaded the next time the device is booted with the SDCARD. (See Figure 32.)

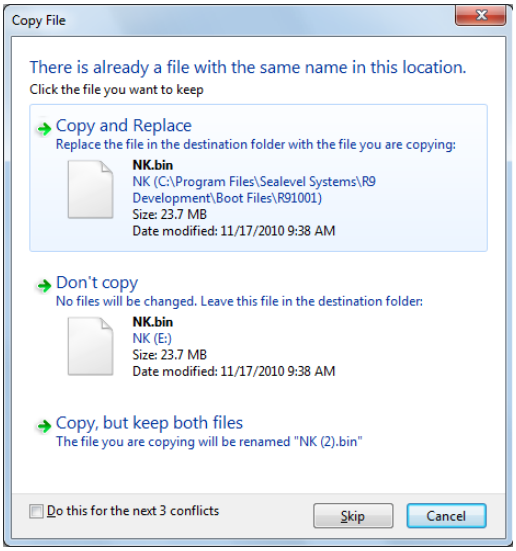

Copy File
There is already a file with the same name in this location.
Click the file you want to keep
Copy and Replace
Replace the file in the destination folder with the file you are copying:
NK.bin
NK (C:\Program Files\Sealevel Systems\R9 Development\Boot Files\R91001)
Size: 23.7 MB
Date modified: 11/17/2010 9:38 AM
Don't copy
No files will be changed. Leave this file in the destination folder:
NK.bin
NK (E:)
Size: 23.7 MB
Date modified: 11/17/2010 9:38 AM
Copy, but keep both files
The file you are copying will be renamed "NK (2).bin"
Do this for the next 3 conflicts
Skip
Cancel

Figure 32. Copy and Replace

USB CONNECTION: USING WINDOWS MOBILE DEVICE CENTER OR ACTIVESYNC

Another way to upgrade the OS runtime image is to connect via Windows Mobile Device Center or Active Sync; for instructions on installing Windows Mobile Device Center or ActiveSync refer to the Relio R9 Quick Start section above.

Using the device file explorer, navigate to the "Storage Card" folder to view the SDCARD contents. (See Figures 33/34.)

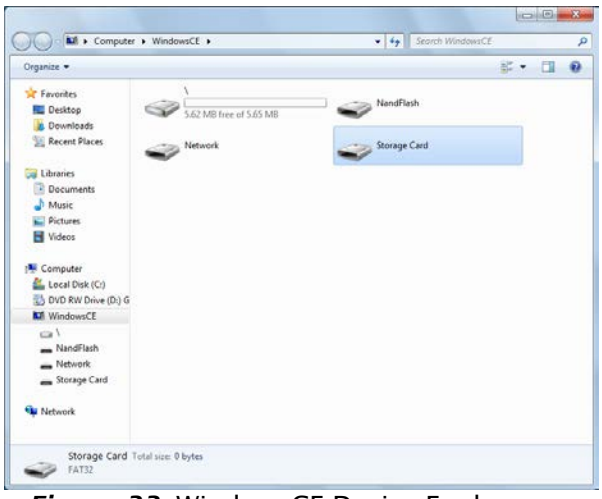


Figure 33. WindowsCE Device Explore

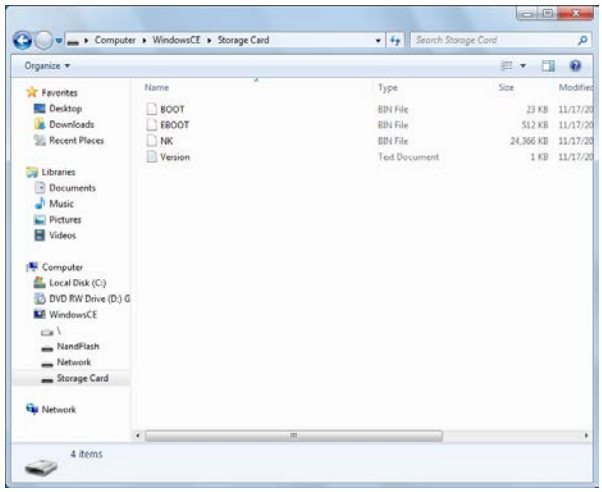


Figure 34. Storage Card contents

To save the existing OS runtime image, backup the SDCARD contents.

Copy the new OS runtime image to the SDCARD. A popup will appear asking you to over-write your current files. (See Figure 35.)

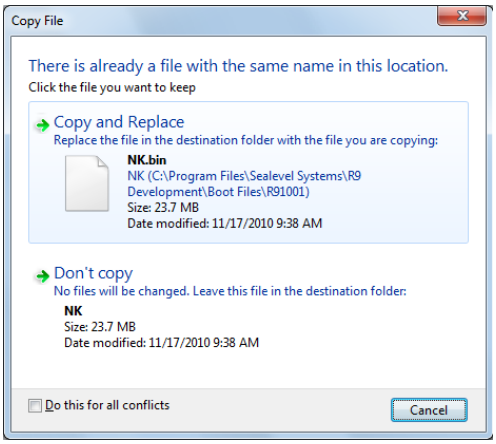

Copy File
There is already a file with the same name in this location.
Click the file you want to keep
Copy and Replace
Replace the file in the destination folder with the file you are copying:
NK.bin
NK (C:\Program Files\Sealevel Systems\R9 Development\Boot Files\R91001)
Size: 23.7 MB
Date modified: 11/17/2010 9:38 AM
Don't copy
No files will be changed. Leave this file in the destination folder:
NK
Size: 23.7 MB
Date modified: 11/17/2010 9:38 AM
Do this for all conflicts
Cancel

Figure 35. Copy and Replace

Select the "Copy and Replace" option to over-write the existing OS runtime image. Reboot the Relio R9 once the file has been copied. The new OS runtime image will be loaded on bootup.

FTP CONNECTION

Use an FTP program to connect to the Relio R9 and upload the new OS runtime image to the SDCARD. FileZilla (See Appendix A), an open-source FTP client, is used in the example below. By default, FTP is open to anonymous access with no password needed. (See Figure 36.)

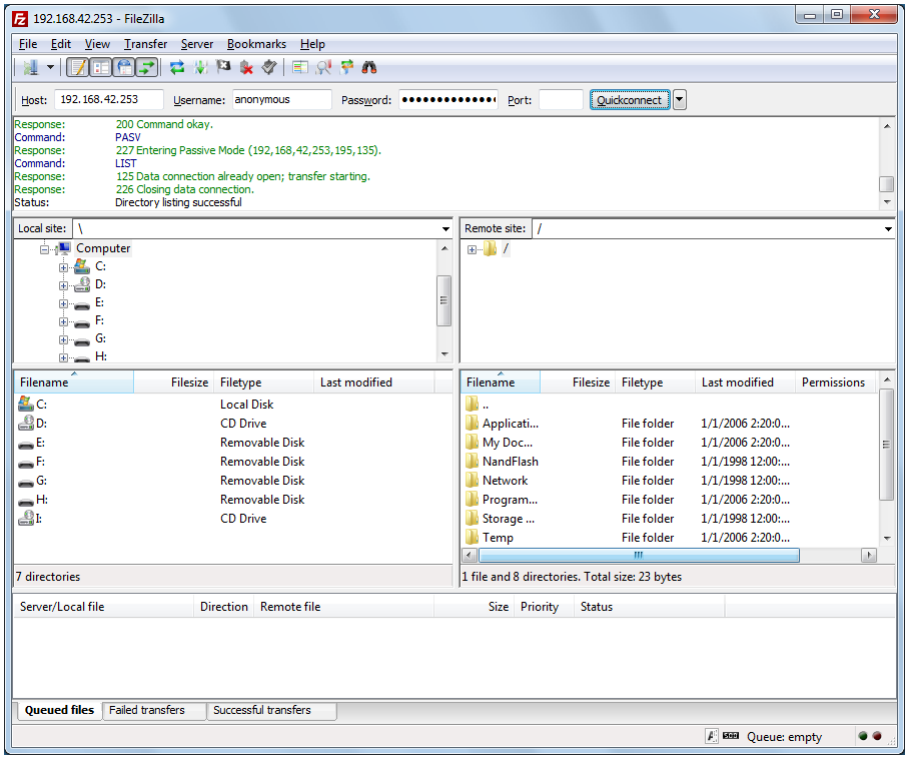


Figure 36. Connect to device through FTP

Select the "Storage Card" folder for the remote site. (See Figure 37.)

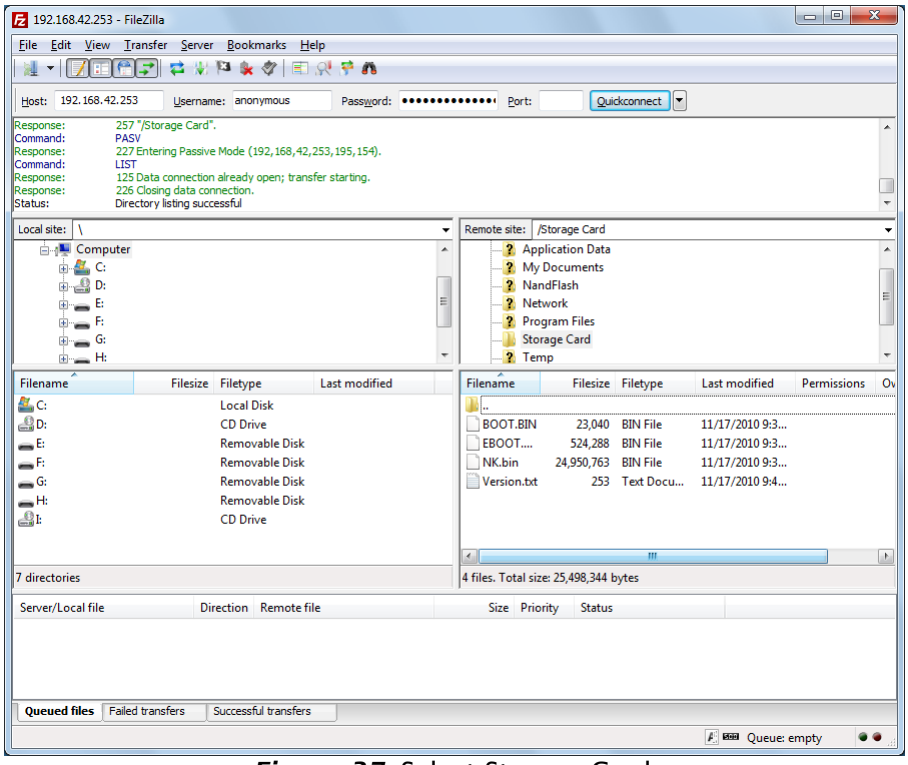


Figure 37. Select Storage Card

Navigate to the “Boot Files” directory of the R9 Development installation. Select the OS Runtime files to copy (*.bin). Right-click and select “Upload” to begin the file transfer. (See Figure 38.)

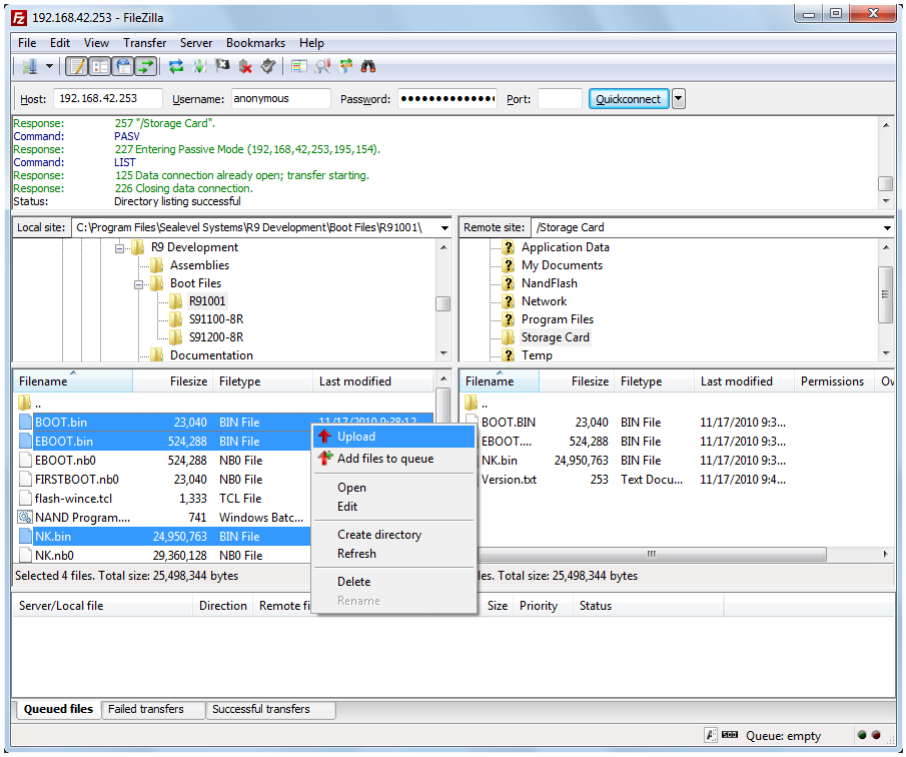


Figure 38. Select boot files to update

You may be asked how to proceed when replacing existing files. Select the “Overwrite” radio button and click “OK”. (See Figure 39.)

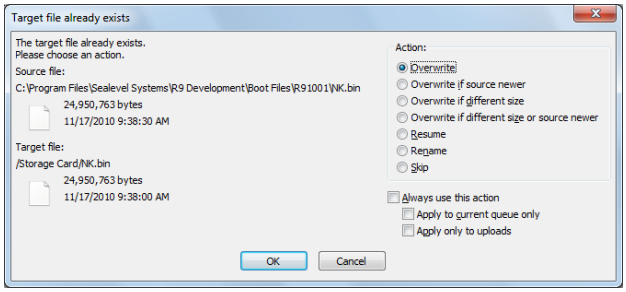


Figure 39. Over-write files

Once the files have been uploaded, (See Figure 40.) reboot the device. The new OS runtime image will be loaded on bootup.

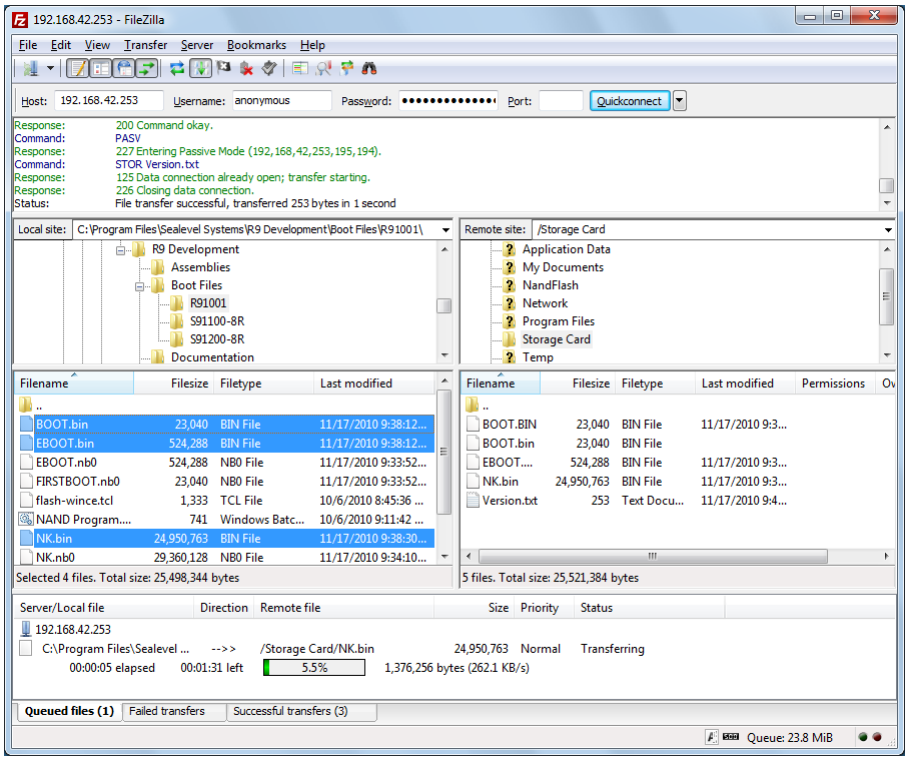

192.168.42.253 - FileZilla
File Edit View Transfer Server Bookmarks Help
Host: 192.168.42.253 Username: anonymous Password: Port: Quickconnect
Response: 200 Command okay.
Command: PASV
Response: 227 Entering Passive Mode (192,168,42,253,195,194).
Command: STOR Version.txt
Response: 125 Data connection already open; transfer starting.
Response: 226 Closing data connection.
Status: File transfer successful, transferred 253 bytes in 1 second
Local site: C:\Program Files\Sealevel Systems\R9 Development\Boot Files\R91001\
R9 Development
Assemblies
Boot Files
R91001
S91100-8R
S91200-8R
Documentation
Remote site: /Storage Card
Application Data
My Documents
NandFlash
Network
Program Files
Storage Card
Temp
Filename Filesize Filetype Last modified
BOOT.bin 23,040 BIN File 11/17/2010 9:38:12...
EBOOT.bin 524,288 BIN File 11/17/2010 9:38:12...
EBOOT.nb0 524,288 NB0 File 11/17/2010 9:33:52...
FIRSTBOOT.nb0 23,040 NB0 File 11/17/2010 9:33:52...
flash-wince.tcl 1,333 TCL File 10/6/2010 8:45:36 ...
NAND Program.... 741 Windows Batc... 10/6/2010 9:11:42 ...
NK.bin 24,950,763 BIN File 11/17/2010 9:38:30...
NK.nb0 29,360,128 NB0 File 11/17/2010 9:34:10...
Selected 4 files. Total size: 25,498,344 bytes
Filename Filesize Filetype Last modified Permissions
BOOT.BIN 23,040 BIN File 11/17/2010 9:3...
BOOT.bin 23,040 BIN File
EBOOT.... 524,288 BIN File 11/17/2010 9:3...
NK.bin 24,950,763 BIN File 11/17/2010 9:3...
Version.txt 253 Text Docu... 11/17/2010 9:4...
5 files. Total size: 25,521,384 bytes
Server/Local file Direction Remote file Size Priority Status
192.168.42.253
C:\Program Files\Sealevel ... --->> /Storage Card/NK.bin 24,950,763 Normal Transferring
00:00:05 elapsed 00:01:31 left 5.5% 1,376,256 bytes (262.1 KB/s)
Queued files (1) Failed transfers Successful transfers (3)
Queue: 23.8 MiB

Figure 40. Uploading boot files

UPGRADING THE OS RUNTIME IMAGE ON NAND FLASH

Factory OS runtime images are stored in the "Boot Files" directory of the R9 Development installation (see Quick start guide). The OS runtime image present in the NAND Flash is programmed through the USB device port connection. Prior to programming an OS runtime, the existing image must be erased. The procedure to erase the NAND Flash is documented in the Debug Port section.

Once the NAND Flash has been erased, use a standard USB device cable and connect the Type B connector to the Relio R9. Connect Type A connector into the host PC. *(See Figure 41.)*

Figure 41. TR123 tinned leads and Type B USB connector

In Microsoft Windows 7, the device is recognized as a GPS camera and will typically enumerate as a COM port. Check the device manager to determine the COM# associated with the device. If prompted with the New Hardware wizard or the device is not recognized, then install the driver using the following steps (XP menus shown, but Vista is similar). In the Found New Hardware Wizard, specify "Install from a list or specific location" and click Next. (See Figure 42.)

Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
This wizard helps you install software for:
AT91 USB to Serial Converter
If your hardware came with an installation CD or floppy disk, insert it now.
What do you want the wizard to do?
Install the software automatically (Recommended)
Install from a list or specific location (Advanced)
Click Next to continue.
< Back
Next >
Cancel

Figure 42. Found New Hardware Wizard

Select "Search for the best driver in these locations" and check "Include this location in the search". Use the Browse button to browse to the “Utilities\SAM-BA\XP driver” directory of the R9 Development installation and click “Next”.

The driver should be installed, and will come in as "AT91 USB to Serial Converter." Click Finish to complete. (See Figure 43.)

Found New Hardware Wizard
Completing the Found New Hardware Wizard
The wizard has finished installing the software for:
AT91 USB to Serial Converter
Click Finish to close the wizard.
< Back
Finish
Cancel

Figure 43. Driver Installed

Determine COM port assignment using Device Manager > Ports. The USB function port should be listed. For Windows 7, it may be listed as a GPS camera, otherwise it should be “AT91 USB to Serial Converter.” Take note of the COM port assignment, to modify the programming batch file used to program the new OS Runtime image. (See Figure 44.)

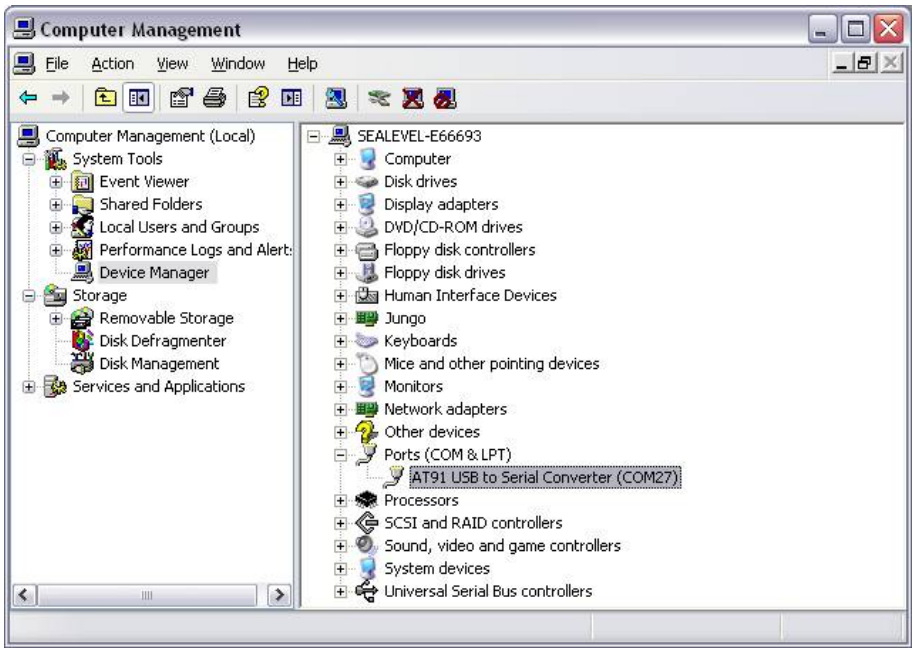


Figure 44. AT91 COM Port

Sample scripts have been provided in the R9 Development installation to automate the process of writing a complete OS runtime to the device. The script is configured to target a device attached to COM49 by default. This can be modified simply by editing the comport variable in the "NAND Program.bat" batch file. Once the batch file has been updated to reflect your system configuration, simply double-click the batch file to begin the programming process. The process will take a few minutes. (See Figure 45).

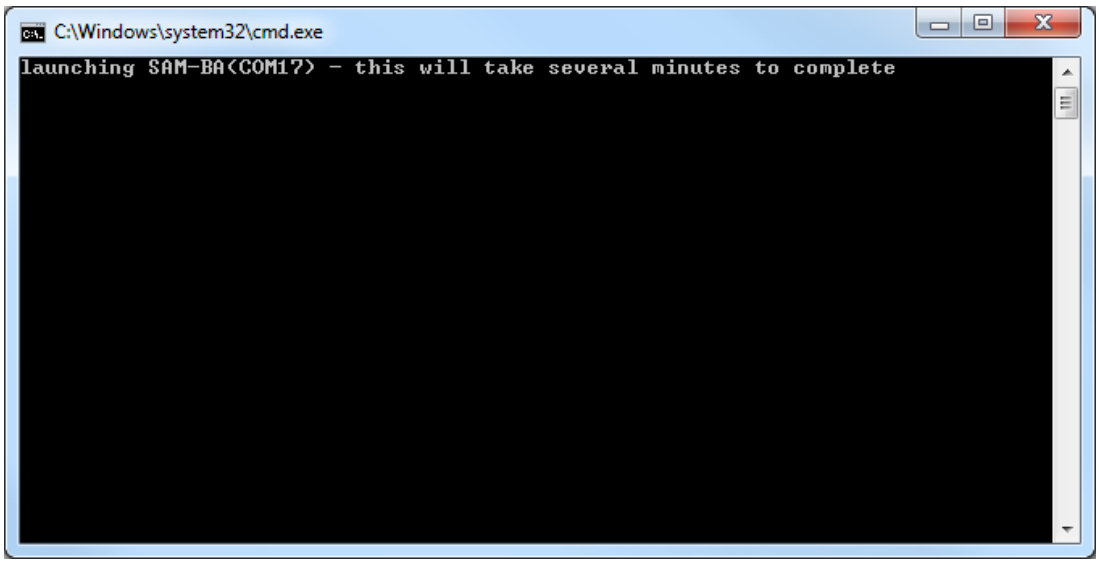


Figure 45. Programming NAND (COM17)

Once programming has completed, cycle device power and the OS runtime should boot. (See Figure 46.)

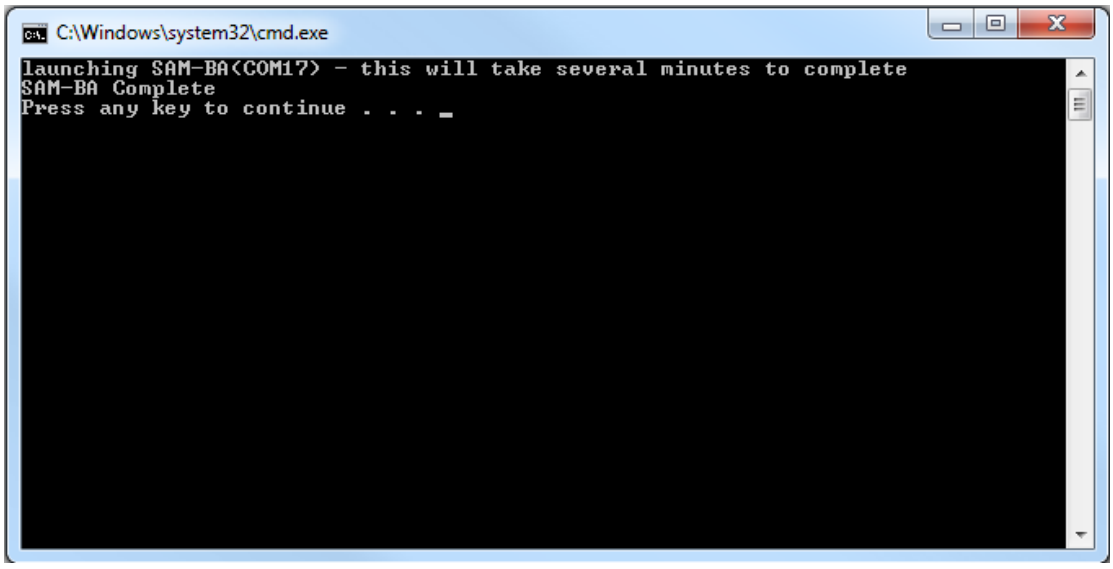

C:\Windows\system32\cmd.exe
launching SAM-BA(COM17) - this will take several minutes to complete
SAM-BA Complete
Press any key to continue . . .

Figure 46. Programming complete

As previously mentioned the process of programming the NAND Flash first erases all content from the NAND Flash. This includes the unique MAC address assigned to your device at the factory. The "finalize.exe" tool is provided in the "Boot Files" directory of the R9 Development installation. Finalize is a command line utility that accepts a MAC address in dashed notation (00-0A-0B-16-12-34). The application should be executed on the device after reprogramming the NAND Flash to reassign the MAC address. Once the application has been executed, the setting is applied upon device restart and persists.

NETWORK CONFIGURATION

The Windows CE that runs on the Relio R9 is initially configured obtain its IP address via DHCP. Settings may be required for DNS or WINS server IP addresses or if you want to set up a static IP address. We have included an application in the OS that enables device configuration through a simple XML file format. The configuration is stored in a file that is kept up-to-date on the NAND Flash of the device. Likewise, edits to this file can be read as requests to modify the device's configuration. The configuration file can be accessed through ActiveSync using the USB device port connection or through an FTP client if you already know the IP address of the device. This section defines the XML configuration structure and corresponding values applicable for each element of the structure. Throughout this section the following definitions apply:

Term	Definition	Example
[int]	A number	123
[String]	Series of printable characters	This is a test string!234567609
[Multi-line String]	strings separated by \r\n	A\r\nNew\r\nMulti-liner
[Version]	A version number	1.2.3.4
[Boolean]	A binary state	True / False
[MACAddress]	A hardware identifier	00-0A-0B-16-11-1A
[IPAddress]	An IPv4 network address	192.168.0.100

The act of writing a new configuration file to the device will trigger a scan of that file (approximately every 10 seconds). If the file is invalid, it will be replaced with the current configuration. If a single element is invalid, that element and corresponding elements will be replaced with default values. To apply a new configuration, use the <Action> element with a value of "apply" as documented below.

```
<?xml version='1.0'?>
<Configuration>
    <System>
        <OS>WinCE</OS>
        <Version>6.0.0</Version>
        <Runtime>Proconex</Runtime>
        <RuntimeVersion>1.0.0.6</RuntimeVersion>
        <Processor>ATMEL, ARM926EJ-S-AT91SAM9263</Processor>
        <Name>WindowsCE</Name>
        <Description>WindowsCE Device</Description>
        <Owner></Owner>
        <Company></Company>
        <Address></Address>
        <Phone></Phone>
        <Extension></Extension>
    </System>
    <Ethernet>
        <Interface name="EMACB1">
            <DHCP>True</DHCP>
            <MAC>00-0A-0B-16-11-1A</MAC>
            <IPAddress>192.168.99.101</IPAddress>
            <Subnet>255.255.255.0</Subnet>
            <Gateway>192.168.99.1</Gateway>
            <Wifi enabled="True">
                <SSID>TESTNETWORK</SSID>
                <Mode>Infrastructure</Mode>
                <Channel>11</Channel>
                <Security>Wpa2Aes</Security>
                <Key encoding="Pass">********</Key>
            </Wifi>
        </Interface>
    </Ethernet>
</Configuration>
```

Sample configuration.xml read from device.

<CONFIGURATION> -STRUCTURE

The configuration element is the root XML element. This element must be present or the configuration file will not be considered valid. Invalid configurations will be replaced with a default configuration.

<SYSTEM> -STRUCTURE

The system element contains all of the system information elements. This element must be a child of the Configuration element. This element must be present or the configuration file will not be considered valid.

<OS> - READONLY [STRING]

The OS element contains a string representation of the Operating System name. This element must be a child of the System element. In the case of R9 products, this will be equivalent to "WinCE".

<VERSION> - READONLY [VERSION]

The version element contains a dot-notation version string. This element must be a child of the System element. This version is associated with the Operating System element.

<RUNTIME> - READONLY [STRING]

This element contains a string representation of the specific OS Runtime Image. This element must be a child of the System element.

<RUNTIMEVERSION> - READONLY [VERSION]

This element contains a dot-notation version string. This element must be a child of the System element. This version is associated with the OS Runtime Image.

<PROCESSOR> - READONLY [STRING]
This element contains a Processor Identification string. This element must be a child of the System element.

<NAME> - READ/WRITE [STRING]
This element may contain the device name string. This element must be a child of the System element. This identifier is used as the WinCE host name.

<DESCRIPTION> - READ/WRITE [STRING]
This element may contain the device description string. This element must be a child of the System element. This element can be used to further identify a device.

<OWNER> - READ/WRITE [STRING]
This element may contain a string that can be used to identify a person or department responsible for maintaining a device. This element must be a child of the System element.

<COMPANY> - READ/WRITE [STRING]
This element may contain a string that can be used to identify the Company to which the device Owner is associated. This element must be a child of the System element.

<ADDRESS> - READ/WRITE [MULTI-LINE STRING]
This element may contain a multi-line string (\r\n separated) to identify the location of the device Owner. This element must be a child of the System element.

<PHONE> - READ/WRITE [STRING]
This element may contain a string representation of a telephone contact number for the device Owner. This element must be a child of the System element.

<EXTENSION> - READ/WRITE [STRING]
This element may contain a string representation of a telephone extension for the device Owner. This element must be a child of the System element.

<ETHERNET> - STRUCTURE
The Ethernet element contains a list of Ethernet interfaces available to the device. This element must be a child of the Configuration element.

<INTERFACE NAME=""> - STRUCTURE (ATTRIBUTE READONLY [STRING])
The interface element is a container for the interface settings that are specific to the interface identifiable as "name". This element must be a child of the Ethernet element. The name attribute is readonly and is used to uniquely distinguish Interface settings for the case where there are multiple Ethernet interfaces available.

<DHCP> - READ/WRITE [BOOLEAN]
This element contains a Boolean value indicating whether DHCP Address resolution is enabled or disabled. This element must be a child of the Ethernet element. Valid values are True or False.

<MAC> - READONLY [MACADDRESS]
This element contains a dash delimited string containing the unique MAC address of this interface. This element must be a child of the Ethernet element. The first 3 octets identify the device as a Sealevel product (00-0A-0B). The fourth octet can be used to determine the product family (16). And the last two octets will be unique for each device (11-1A).

<IPADDRESS> - READ/WRITE [IPADDRESS]
This element may contain the current DHCP acquired IP Address or the current static IP address depending on the state of the DHCP element. This element must be a child of the Ethernet element. Assigning a value to this element when DHCP is enabled has no effect.

<SUBNET> - READ/WRITE [IPADDRESS]

This element may contain the current DHCP acquired Subnet Mask or the current static Subnet Mask depending on the state of the DHCP element. This element must be a child of the Ethernet element. Assigning a value to this element when DHCP is enabled has no effect.

<GATEWAY> - READ/WRITE [IPADDRESS]

This element may contain the current DHCP acquired Gateway address or the current static Gateway address depending on the state of the DHCP element. This element must be a child of the Ethernet element. Assigning a value to this element when DHCP is enabled has no effect.

<WIFI ENABLED=""> - STRUCTURE (ATTRIBUTE READONLY)

The Wifi element is a container for wireless bridge settings if such a bridge is present. This element must be a child of the Ethernet element. The "enabled" attribute will reflect whether the Interface is able to communicate with an approved wireless bridging module.

<SSID> - Read/Write [string]

This element contains the SSID string to be used when forming the wireless connection. This element must be a child of the Wifi element.

<Mode> - Read/Write [string: Adhoc, Infrastructure]

This element contains the overall Wireless configuration mode. This element must be a child of the Wifi element.

<Channel> - Read/Write [int: 1,11]

This element contains the wireless channel offset to use in Adhoc mode. This element must be a child of the Wifi element.

<Security> - Read/Write [string: None, WepOpen64, WepOpen128, WepShared64, WepShared128, WpaTkip, Wpa2Aes, Wpa2Tkip]

This element contains the security method for use in establishing the wireless connection. This element must be a child of the Wifi element.

<Key encoding=""> Writeonly [string] (Attribute [string: Hex, Ascii, Pass])

This key is used to set the wireless connection passphrase or value. This element must be a child of the Wifi element. Depending on the wireless configuration, the "encoding" attribute will need to be set accordingly. For security purposes this value cannot be read once it has been set.

<SEALEVEL> - STRUCTURE

The Sealevel element contains a list of Sealevel internal configuration parameters used for Sealevel supplied software plug-ins. This element must be a child of the Configuration element. The plug-in application should contain documentation for the configuration parameters used by that plug-in.

<USER> - STRUCTURE

The User element can be used to contain a list of user configurable parameters for use in custom software. This element must be a child of the Configuration element. Any elements stored under this element will be automatically persisted to the registry key HKLM/Software/User. They can be accessed through that key at any time by custom software.

<ACTION> - WRITEONLY [STRING]

This element may be used to trigger predetermined device behavior. This element must be a child of the Configuration element. For example, setting a value of "apply" to this element will result in the specified configuration being applied to the hardware and trigger a device restart so the settings will take effect.

Specifications

DIMENSIONS

Length	Width	Height
7.5”	5.1”	1.3”

For CAD drawing with dimensions, see Appendix D – CAD Drawing.

POWER

Supply Line	7 – 30VDC Input
Rating	10 W Max (2.5W Nominal)

Connector: 7 – 30VDC / GND on left side of enclosure
Manufacturer: Weco
Part Number: 121-M-211/02
Description: 2 Position Right Angle 5.08mm Header
Mates with: Weco 121-A-111/02 2 Position 5.08mm Pluggable Screw Terminal

ENVIRONMENTAL SPECIFICATIONS

Specification	Operating	Storage
Temperature Range	-40° to 85° C	-60° to 150° C
Humidity Range	10 to 90% R.H. Non-Condensing	10 to 90% R.H. Non-Condensing

MANUFACTURING

All Sealevel Systems printed circuit boards are built to UL 94V0 rating and are 100% electrically tested. These printed circuit boards are solder mask over bare copper or solder mask over tin nickel.

Appendix A – Resources

BOOKS

Professional Microsoft Windows Embedded CE 6.0, Wrox, Phung.
http://it-ebooks.info/book/1461/

Programming Windows Embedded CE 6.0 Developer Reference, Microsoft Press, Boling.
https://www.microsoft.com/learning/en-us/book.aspx?id=11064Web Sites

WEBSITES

Atmel SAM-BA In-System Programmer (ISP)
http://www.atmel.com/tools/atmelsam-bain-systemprogrammer.aspx

FileZilla Open-Source FTP Client
http://www.filezilla-project.org

Microsoft Windows Embedded Home Page
http://www.microsoft.com/windowsembedded/en-us/windows-embedded.aspx

Microsoft Windows Embedded CE 6.0 Online Documentation
https://msdn.microsoft.com/en-us/library/ee504812(v=winembedded.60).aspx

Microsoft ActiveSync Download
http://www.microsoft.com/windowsmobile/en-us/help/synchronize/ActiveSync-download.mspx

Microsoft Mobile Device Center 6.1
https://support.microsoft.com/en-us/kb/931937

Microsoft .NET Compact Framework
https://msdn.microsoft.com/en-us/library/ms376787.aspx

PuTTy Telnet/SSH Client Application
http://en.wikipedia.org/wiki/PuTTY

Appendix B – Relio R9 Internal Connector Reference

The following table details the connectors, jumpers, and test points located inside the Relio R9. To access you will need to remove the cover of the Relio R9. The connectors, jumpers, and test points are labeled by reference designator on the board silkscreen.

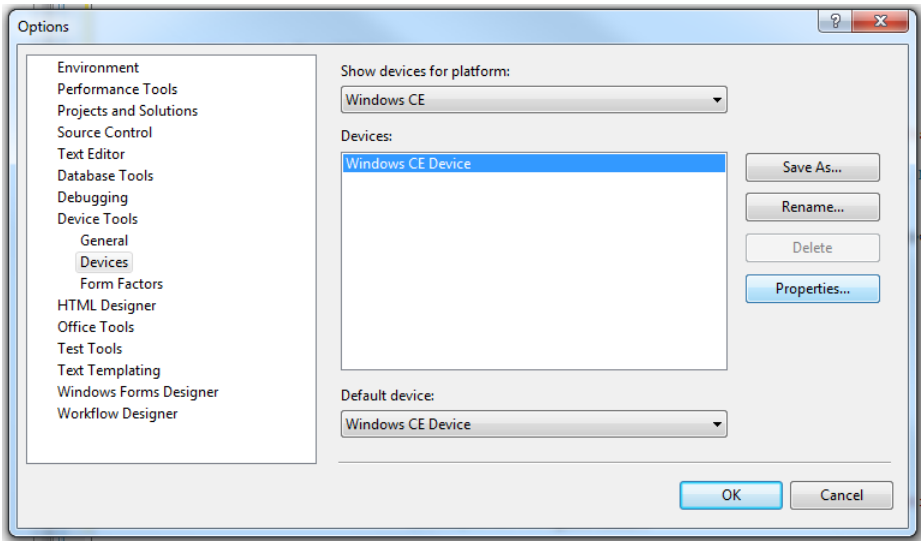
Reference Designator	Signal Description
P2	LCD, Backlight, and touchscreen controller
J6	RS-232 serial debug port
Jumpers	
J1	Jumper - NAND Flash write protect
J2	Jumper - NAND Flash enable (Installed by default)
J4	Jumper - CAN Bus Termination (Installed by default)
J16	Jumper - Enable Push-button Reset (Installed by default)
Test Points	
TP1	Test Point - Analog ground
TP2	Test Point - Received analog input
TP3	Test Point – Ground
TP4	Test Point – Ground

Appendix C – Application Debugging over Ethernet

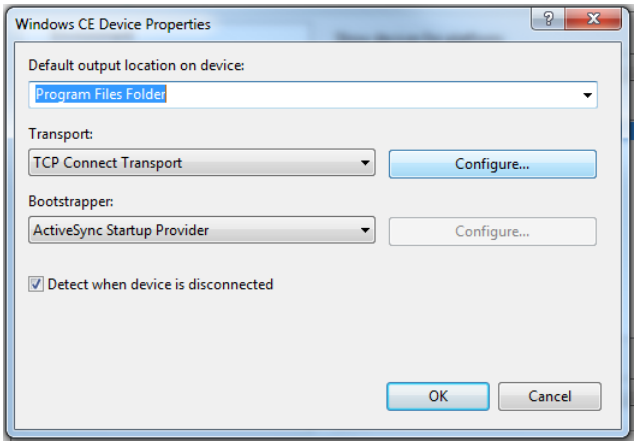
Applications can be debugged over an Ethernet connection in place of USB by configuring Visual Studio to directly connect to your device. For this method to work properly, the Ethernet connection to the device must be properly configured to allow normal TCP/IP communications and you must know the IP address of the device you wish to execute the application on. For further information about configuring the Ethernet of the device see the Network Configuration section.

To configure Visual Studio to use your device for debugging over Ethernet, click the "Device Options" button on the Device toolbar. See below.

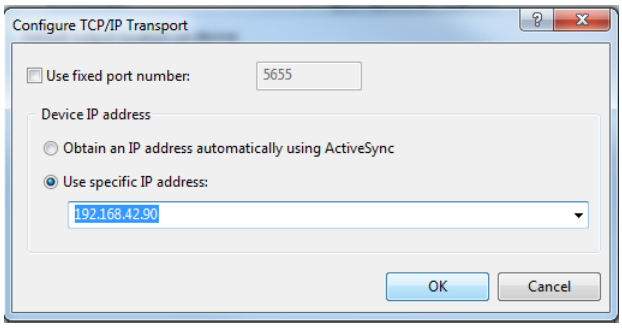
On the "Device Options" dialog, select the "Windows CE" platform and click the "Properties…" button. See below.



On the "Windows CE Device" properties dialog click the "Configure…" button. See below.

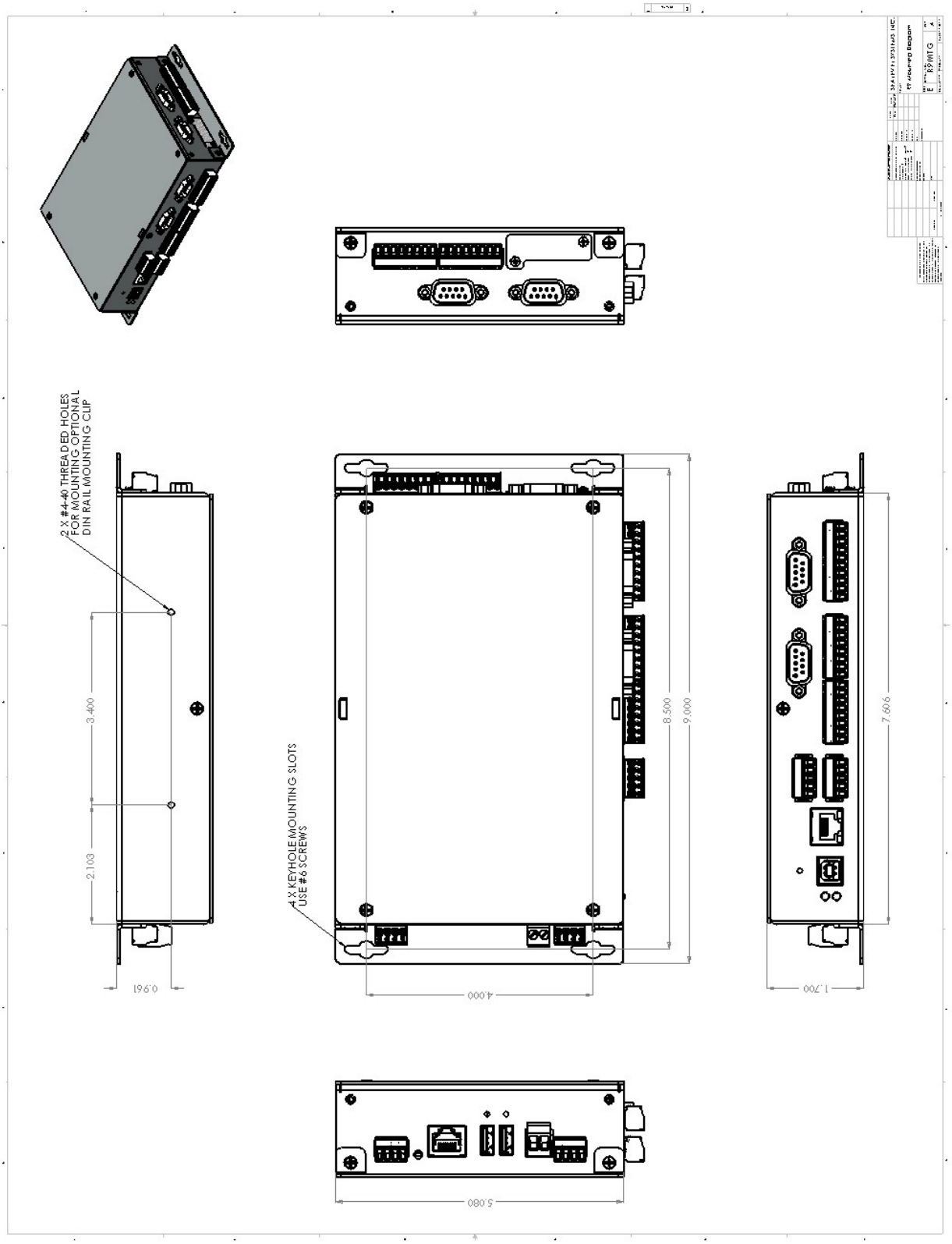


Now click the “Use specific IP address” radio button and type the IP address of the device in the text box. See below.



Click the “OK” button on all of the dialog windows and you should now be able to connect to the device through Ethernet for debugging. The application debugging guide can be continued as normal.

Appendix D – CAD Drawing



Appendix E – How to Get Assistance

When calling for technical assistance, please have the device installed and ready to run diagnostics. If possible, have your user manual and current settings ready.

The Sealevel website is an excellent resource located at www.sealevel.com. The most current software updates and user manuals are available via our homepage by clicking on the 'Drivers' or 'Manuals' links located under 'Technical Support.' Manuals and software can also be downloaded from the product page for your device.

The FAQ section of our website answers many common questions. Refer to this helpful resource by visiting www.sealevel.com/faq.asp.

TECHNICAL SUPPORT

Monday – Friday
8:00 am to 5:00 pm EST
Phone: +1 (864) 843-4343
Email: support@sealevel.com

RETURN AUTHORIZATION MUST BE OBTAINED FROM SEALEVEL SYSTEMS BEFORE RETURNED MERCHANDISE WILL BE ACCEPTED. AUTHORIZATION CAN BE OBTAINED BY CALLING SEALEVEL SYSTEMS AND REQUESTING A RETURN MERCHANDISE AUTHORIZATION (RMA) NUMBER.

Warranty

Sealevel's commitment to providing the best I/O solutions is reflected in the Lifetime Warranty that is standard on all Sealevel manufactured I/O products. Relio™ industrial computers are warranted for a period of two years and the Relio™/SeaPAC™ /SBC R9 family is warranted for a five year period from date of purchase. We are able to offer this warranty due to our control of manufacturing quality and the historically high reliability of our products in the field. Sealevel products are designed and manufactured at its Liberty, South Carolina facility, allowing direct control over product development, production, burn-in and testing. Sealevel achieved ISO-9001:2000 certification in 2002.

WARRANTY POLICY

Sealevel Systems, Inc. (hereafter "Sealevel") warrants that the Product shall conform to and perform in accordance with published technical specifications and shall be free of defects in materials and workmanship for the warranty period. In the event of failure, Sealevel will repair or replace the product at Sealevel's sole discretion. Failures resulting from misapplication or misuse of the Product, failure to adhere to any specifications or instructions, or failure resulting from neglect, abuse, accidents, or acts of nature are not covered under this warranty.

Warranty service may be obtained by delivering the Product to Sealevel and providing proof of purchase. Customer agrees to insure the Product or assume the risk of loss or damage in transit, to prepay shipping charges to Sealevel, and to use the original shipping container or equivalent. Warranty is valid only for original purchaser and is not transferable.

This warranty applies to Sealevel manufactured Product. Product purchased through Sealevel but manufactured by a third party will retain the original manufacturer's warranty.

NON-WARRANTY REPAIR/RETEST

Products returned due to damage or misuse and Products retested with no problem found are subject to repair/retest charges. A purchase order or credit card number and authorization must be provided in order to obtain an RMA (Return Merchandise Authorization) number prior to returning Product.

HOW TO OBTAIN AN RMA (RETURN MERCHANDISE AUTHORIZATION)

If you need to return a product for warranty or non-warranty repair, you must first obtain an RMA number. Please contact Sealevel Systems, Inc. Technical Support for assistance:

Available	Monday – Friday, 8:00AM to 5:00PM EST
Phone	864-843-4343
Email	support@sealevel.com

TRADEMARKS

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